





# Transportation Data Pedigree Form

Complete only applicable items.

<b>Subcontractor:</b> Nevada Rail Partners	<b>Item Number/Title/Revision:</b> T15/Operations and Maintenance – <i>Operations and Maintenance Report, Caliente Rail Corridor</i> – NRP-R-SYSW-OM-0001-03, Rev. 03, Exhibit I, Item Number 17i, RFP Reference Exhibit D-2.15a.2	<b>Submittal Date:</b> May 15, 2007	<b>SRCT No.:</b> 06-00015
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**Section I. Submittal Information** (includes above information)

**Submittal Description and Revision Summary for Entire Submittal:**  
 The document included in this submittal is revised from the previous Rev. 02A submittal in January 2007. The redline changes submitted as Rev. 02A of this document have been accepted by BSC. The new changes shown in the PDF file containing the Rev. 03 redlines resulted from the comment resolution process for the Rev. 02A submittal.  
 In addition, the Rev. 02A cask maintenance facility (CMF) text was reviewed and revised by BSC. The current Rev. 03 CMF discussion includes the revised text provided by BSC. Please note that BSC has confirmed the number of waste package cars totals 2,823. This Rev. 03 submittal reflects the change in Table 1 from 1,412 to 2, 823.

**Special Instructions:**  
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**Section II. Data File Information** (Add lines below if needed for additional files. Indicate "Last item" or "End of list" on last line used.)

Filename	Rev.	File Size	Description (File description and revision summary for file)	Application and Version/ Add-in or Extension and Version
T15_Cover.ppt	03	701 KB	Report cover for <i>Operations and Maintenance Report, Caliente Rail Corridor</i> - NRP-R-SYSW-OM-0001-03, Rev. 03	Microsoft Powerpoint 2003
T15_CRC_OM_FINAL_Rev03_15_May07.doc	03	19,372 KB	Main text with all graphics and appendices - <i>Operations and Maintenance Report, Caliente Rail Corridor</i> - NRP-R-SYSW-OM-0001-03, Rev. 03	Microsoft Word 2003
T15_CRC_OM_FINAL_Rev03_15_May07.pdf	03	5,373 KB	Scanned final version of the complete document with all imbedded graphics and appendices - <i>Operations and Maintenance Report, Caliente Rail Corridor</i> - NRP-R-SYSW-OM-0001-03, Rev. 03	Adobe Acrobat 7.0 Standard Version
T15_CRC_OM_FINALReadonly_Rev03_15May07.doc	03	19,368 KB	Main text (Read Only) with all graphics and appendices - <i>Operations and Maintenance Report, Caliente Rail Corridor</i> - NRP-R-SYSW-OM-0001-03, Rev. 03	Microsoft Word 2003
T15_CRC_OM_FINALredlines_Rev03_15May07.pdf	03	4,400 KB	Scanned redline version of the complete document with all imbedded graphics and appendices - <i>Operations and Maintenance Report, Caliente Rail Corridor</i> - NRP-R-SYSW-OM-0001-03, Rev. 03	Adobe Acrobat 7.0 Standard Version
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Suitable for Review? <input checked="" type="checkbox"/> Yes* <input type="checkbox"/> No	Screener Name: Cathy Stettler	Signature: Cathy Stettler	Date: 5/11/07
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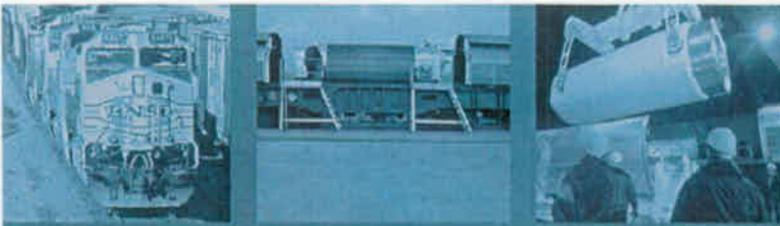
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*5/14/07*



# Operations and Maintenance Report Caliente Rail Corridor

**Task 15: Operations & Maintenance Planning Support  
Rev. 03**

**Document No. NRP-R-SYSW-OM-0001-03**

prepared by:



prepared for:



Nevada Rail Line Conceptual Design

Subcontract NN-HC4-00239

May 15, 2007

# **Operations and Maintenance Report Caliente Rail Corridor**

## **Task 15: Operations and Maintenance Planning Support**

**Rev. 03**

**Document No. NRP-R-SYSW-OM-0001-03**

Nevada Rail Line Conceptual Design

Subcontract NN-HC4-00239

15 May 2007

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### Acronyms

AAR	Association of American Railroads
AREMA	American Railway Engineering and Maintenance-of-Way Association
ATM	Assistant Trainmaster/Road Foreman
BNSF	Burlington Northern Santa Fe
BSC	Bechtel SAIC Company, LLC
CFR	Code of Federal Regulations
CMF	Cask Maintenance Facility
CRC	Caliente Rail Corridor
CSS	Conventional Signal System
CTC	Centralized Traffic Control
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
EOL	End-of-Line
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
GCOR	General Code of Operating Rules
GHS	GROA Home Signal
GM	General Manager
GROA	Geologic Repository Operations Area
HLW	High-level Radioactive Waste
hp	Horsepower
ICC	Interstate Commerce Commission
MOW	Maintenance-of-Way
mph	Miles per hour
NAC	Nevada Administrative Code
NRC	Nuclear Regulatory Commission
NRL	Nevada Rail Line
NTOC	National Transportation Operations Center
NTRD	<i>Nevada Transportation Requirements Document</i>
PBX	Private Branch Exchange
PSTN	Public Switched Telephone Network
RA	Rail Alignment

## List of Tables, Figures and Acronyms

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RIP	Repair-in-Place
ROW	Right-of-Way
SNF	Spent Nuclear Fuel
SONET	Synchronous Optical Network
SSC	Site Specific Cask
STB	Surface Transportation Board
TCC	Train Control Center
TM	Trainmaster
TPC	Train Performance Calculations
UPRR	Union Pacific Railroad
USC	U.S. Code
VHF	Very High Frequency
WP	Waste Packages
YM	Yardmaster/Station Agent

# 1.0 Introduction and Purpose

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The primary purpose of this operations and maintenance report is to provide operations and engineering data to support the Rail Alignment Environmental Impact Statement (RA EIS). The information provided in this operations and maintenance report presents a description of the operational characteristics of the Nevada Rail Line (NRL), and how the capital facilities are to be maintained and be compliant with Federal Railroad Administration (FRA) regulations, as applicable. Figure 1 presents the proposed Caliente Rail Corridor (CRC) and alternative rail segments. The heavy line (blue) is the basis for analysis alignment used to estimate train performance and run times (NRP 2006). Other route segments are under consideration and are indicated by the red lines.<sup>1</sup> Key topics addressed in this report are:

- Train types and traffic projections
- Train movements
- Train control and communications
- Operational interfaces
- Shipping documentation
- Railroad facilities
- Maintenance
- Staffing

The intent is to:

- Provide documentation and support for the conceptual operations and maintenance planning strategies
- Provide a working document for ongoing refinement of the train and yard operating procedures, and maintenance strategies presented herein
- Provide a document for initial input for the U.S. Department of Energy's (DOE) RA EIS subcontractor
- Document the interfaces and agreements between Nevada Department of Transportation, National Transportation Operations, and Geologic Repository Operations Area (GROA) site development engineering personnel. This item includes functional, procedural, operational, and other interface information.

All of the NRL facilities have concepts based on conventional freight rail operations. There are no specific components, infrastructure, or systems to accommodate the practices associated with nuclear materials handling, storage, or operations. In addition, no specific security components, infrastructure, or systems are included in the current NRL concepts.

This report is one of several prepared to support and provide initial input to the draft RA EIS. Each report covers a specific topic for a specific purpose. Accordingly, each report utilizes data from various sources in varying levels of detail and precision as appropriate, as well as in different contexts. While the reports are consistent in overall conceptual design, it is possible that numerical values for certain parameters may vary between the reports. This is the result of the conceptual nature of the reports and their distinct areas of focus – it should not be considered an abnormal situation or an indication of error.

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<sup>1</sup> Many of the operation and maintenance functions described in this report would be administered in a similar manner along any given alignment. Therefore, NRL is used to describe aspects of rail operations and maintenance that are not particular to a specific alignment, and CRC is used only where specifically applicable to the Caliente Rail Corridor.

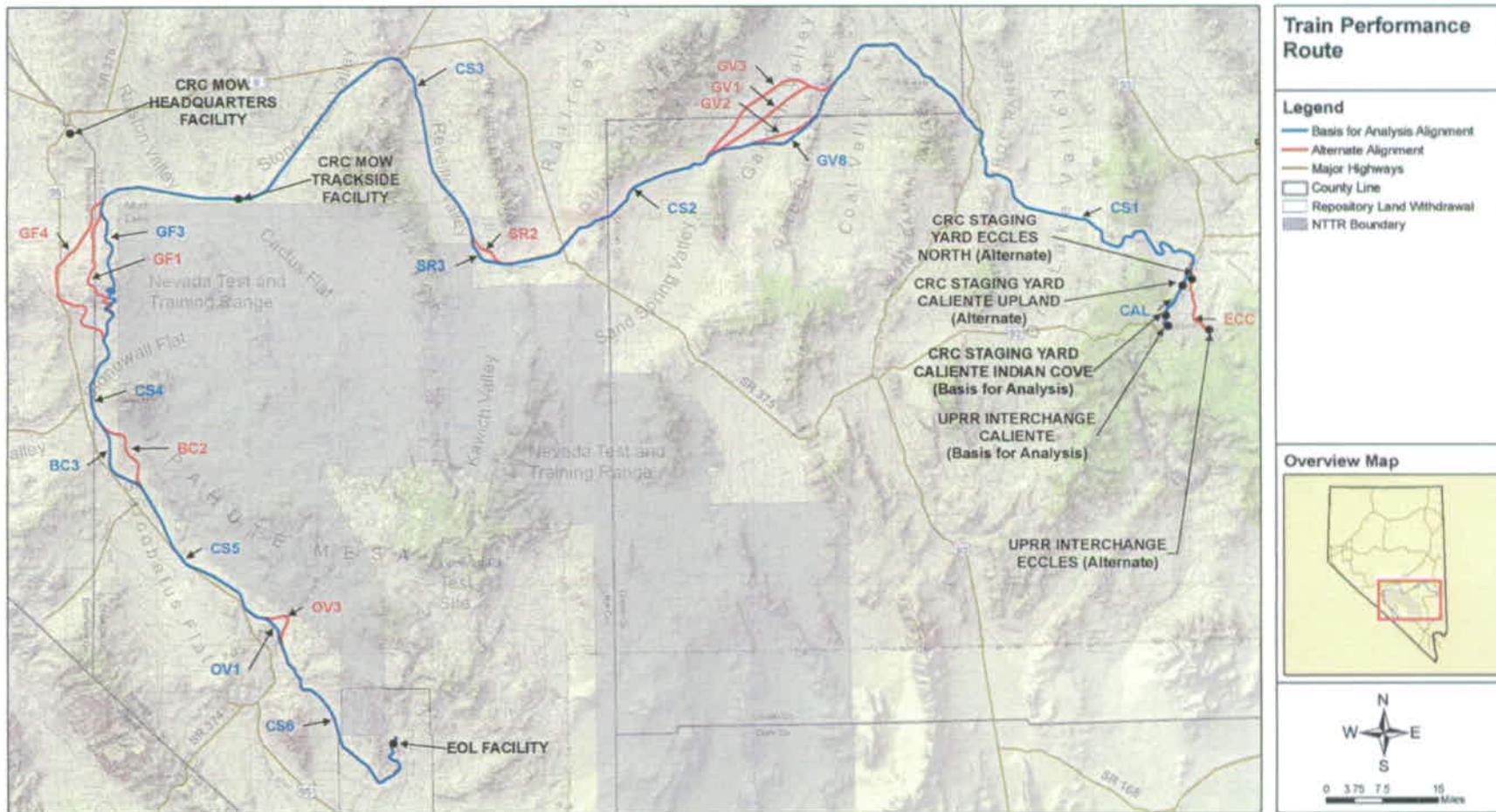


Figure 1. CRC Basis for Analysis Alignment

### 2.1 GENERAL PURPOSE OF RAIL LINE

The primary purpose of the NRL is transport spent nuclear fuel (SNF) and high-level radioactive waste (HLW) to the GROA located at Yucca Mountain, Nevada. The SNF includes both DOE and commercial shipments. In addition, the NRL would also handle shipments supporting the construction of the GROA facilities, waste disposal packages, site specific casks, fuel oil, and other infrequent miscellaneous shipments.

### 2.2 ROUTE LENGTH

The CRC would be constructed between the Union Pacific Railroad (UPRR) in the vicinity of Caliente/Eccles, Nevada, and the GROA site. The route distance ranges between approximately 327 and 335 miles depending upon the final alignment, which is yet to be selected. For purposes of determining run times for trains across the CRC, the basis for analysis alignment was used, which is approximately 331 miles in length.

Throughout this and other NRP reports, the phrase "basis for analysis" is used to provide a frame of reference for NRP's evaluations of the alignment's construction engineering and operational characteristics. Except for this report, NRP reports provide data for all alignment segments so that consideration of other alternative alignment segment combinations may be accomplished. The difference in distances between the longest (335 miles) and shortest (327 miles) is very small (approximately 8 miles) when compared to the overall length and thus these variations will have almost no impact on the operations analysis.

### 2.3 COMMON CARRIER OPERATION

The operation of the NRL would likely be similar to a short line railroad with an independent contractor being responsible for the NRL's operation and maintenance of facilities. Further, although no decision has yet been made by the DOE, the NRL may be operated as a common carrier, certified by the Surface Transportation Board (STB). This potential action would place the NRL into the national rail transportation system enabling the interchange of non-DOE traffic with the nation's railroads. Under this scenario, the NRL would be open to the potential of other traffic (shared use) using its route on a revenue basis.

Current guidelines from DOE are that shared use should not be precluded as specified in the *Nevada Transportation Requirements Document* (NTRD) (Bechtel SAIC Company, LLC [BSC] 2005a). Additional facilities to accommodate shared use would be determined on a case by case basis and paid for by the new shipper. Such facilities could include a spur track serving the new shipper, siding lengthening, new sidings, additional interchange tracks, etc. See Appendix A for additional information regarding common carrier obligations of a railroad.

### 2.4 SINGLE TRACK RAILROAD

The NRL would be a single track railroad. Alignment engineering and operations analysis have the goal of providing an end-point to end-point train run time sufficient (with reserve) to be completed within one train crew's hours of service limit (BSC 2005a). The NRL would be planned, designed, and constructed to accommodate a nominal maximum train speed of 60 miles per hour (mph) (BSC 2005a). However, SNF and HLW trains are limited to a maximum speed of 50 mph per Association of American Railroads (AAR) guideline OT-55. Sidings of about 7,000 feet in length would be provided to pass trains on the route and to provide space for the temporary holding of maintenance vehicles, and to serve other functions (BSC 2005a). The siding site location process would consider the ease of lengthening to accommodate potentially longer trains posed by potential shared use traffic.

### 3.0 General Train Use Strategies for Track Construction

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Trains would be used extensively to support track construction activities by delivering rail, ballast, ties, and other track material. Track construction would begin when the grading and subballast is complete. Ties would be placed on the subballast by rubber mounted vehicles. Welded rail from trains would then be pulled into place on the ties using rollers and other special equipment. Ballast would be dumped from trains on the new track, and subsequently, the track would be lifted on top of the ballast. This would occur in three passes in order to raise the track on top of 12 inches of ballast.

The general approach for train movement is for the rail trains to operate two days a week and the ballast trains to operate five days a week during the track construction phase.

It is anticipated that 80-foot rails would be delivered by rail train (89-foot flat cars) from the manufacturing plants to a portable plant in the Caliente/Eccles area for welding into 1,440-foot strings. CRC dedicated rail trains would distribute the rail from the welding plant to the end of track. It is estimated that two, twenty string (1,440 feet) rail trains would be needed per week. During track construction, the welding plant would be moved from time to time along the route to be in reasonable proximity of the end of track.

Track construction would require about three million tons of ballast. Ballast would be obtained from either commercially available sources, new quarries developed along the CRC alignment, or a combination of the two alternatives. A final determination is yet to be made. Assuming 5,000 ton ballast trains and a five day distribution period per week, about 12 ballast trains per week would be needed during the track construction phase.

As the sources of the ballast are uncertain at this time, development of the circulation patterns for the ballast trains is problematic. However, the number of trains needed to support track construction on a daily basis, as discussed in the above paragraphs, demonstrates the need for careful consideration of siding locations (temporary / permanent) to support construction train movements.

## 4.0 Train Types and Traffic Projections

### 4.1 TRAFFIC PROJECTIONS

Table 1 presents estimated traffic projections of carloads and trains annually by eight traffic categories. Seven of the categories are DOE-related. The source of the traffic numbers for SNF, HLW, Navy, fuel oil, site specific cask/waste packages (SSC/WP) shipments is the NTRD (BSC 2005a). Traffic estimates for trains supporting the construction of GROA facilities do not have a source document to reference; but, represent the latest planning assumptions based on discussions with GROA planning personnel. Commercial traffic was estimated by an outside consultant under contract to Nye County, Nevada (*Rail Transportation Economic Impact Evaluation & Planning*) (WSA 2005). From this carload data and tonnage projections, train counts and gross tons were estimated by year. These data are contained in Appendix B.

Due to various cask car and cask design refinements which are still underway, shipments of SNF, HLW, and Navy HLW to GROA are not finalized and vary between approximately 11,056 and 9,995 cask cars over the projected 25-year program. In terms of railroad movements and tonnages, the difference between assumptions is not significant, amounting to about seven, six-car cask trains per year, as compared to hundreds of trains per year spread over the 25-year period (see Table 1). This type of variation is easily absorbed in the normal ebb and flow of railroad operations. For purposes of this report, it is assumed that that about 10,000 cask cars are shipped.

SNF traffic is projected to move to the repository for a period of approximately 25 years. Waste disposal containers continue to move to GROA for about an additional three years. Fuel oil trains to support GROA operations, and potential commercial shared use traffic are projected through the 50-year life of the NRL. Maintenance-of-way (MOW) trains are not included.

As indicated in Table 1, repository construction material and seasonal (October – March) fuel oil traffic are a significant portion of the DOE-related carloads. These two traffic categories constitute 64 percent of DOE-related carloads and 34 percent of DOE-related trains. The proportional variance is accounted for by the much higher tons per train of construction material and the 50-year operating span for the fuel oil trains. SNF and HLW trains move as individual units from point of origin and are promptly dispatched after arrival at the staging yard.

At the time of this document's release, the planning assumptions for construction duration of both the CRC and the repository remain dynamic over a large range. In addition, planning assumptions for train consists (the rail configuration of engine and cars) and traffic levels remain as draft documents that are circulating for review and comment. Lastly, the planned duration for SNF transportation to the repository extend over a 2:1 range – 25 years to 50 years. This document captures operation considerations that as much as possible allow for these current range of possibilities. As the basis for these considerations becomes more definitive, this document's data and analyses would also require updating.

### 4.2 NEVADA RAIL GROSS TONNAGE PROJECTION

In order to determine the actual gross tonnage density on the line, certain assumptions about train size and train weight were made. These assumptions are contained in Appendix C.

Gross tons per train factors for SNF include the following:

- Average number of casks per train in a given year
- Number of locomotives per train
- Two buffer cars per train
- One escort car per train

Each item above has a standard gross weight on rail, including loaded and empty casks.

## 4.0 Train Types and Traffic Projections

**Table 1. Estimated Traffic Projections of Carloads and Trains**

Year	Commercial SNF		HLW		DOE SNF		NAVY		SSC	WP (2/car)		Repos Construct'n		Fuel Oil		Comm'l Shared Use		TOTAL	
	Cars	Trains	Cars	Trains	Cars	Trains	Cars	Trains		Cars	Trains	Cars	Trains	Cars	Trains	Cars	Trains	Cars	Trains
1	30	10	39	20	2	2	3	1	200	27	33	1,467	37	122	13	4,440	156	6,317	272
2	80	27	77	39	4	4	3	1	200	47	36	1,467	37	163	26	6,630	208	8,648	378
3	114	29	77	39	9	9	6	1	200	65	38	1,467	37	163	26	7,970	260	10,039	439
4	224	45	77	39	14	14	6	1	200	89	41	1,467	37	163	26	9,010	260	11,206	483
5	314	53	77	39	18	18	12	2	200	122	40	1,467	37	163	26	10,293	260	12,605	475
6	365	61	77	39	24	12	13	3	200	123	40	1,467	37	163	26	10,293	260	12,684	478
7	326	55	77	39	27	14	14	3	200	120	40	1,467	37	163	26	10,293	260	12,827	474
8	329	55	77	39	28	14	15	3	200	123	40	1,467	37	163	26	10,293	260	12,634	474
9	312	52	86	43	28	14	15	3	200	123	41	1,467	37	163	26	10,293	260	12,626	476
10	316	53	130	44	28	14	15	3	200	142	43	1,467	37	163	26	10,293	260	12,683	480
11	316	53	130	44	28	14	15	3	100	142	35	1,467	37	163	26	10,293	260	12,583	472
12	323	54	130	44	28	14	15	3		140	46			163	26	10,293	260	11,022	447
13	345	58	139	46	28	14	15	3		145	48			163	26	10,293	260	11,056	455
14	338	57	144	48	30	15	15	3		144	48			163	26	10,293	260	11,055	457
15	330	55	148	50	34	17	14	3		147	49			163	26	10,293	260	11,056	480
16	341	57	153	51	42	14	14	3		123	41			163	26	10,293	260	11,068	452
17	335	56	153	51	47	16	14	3		148	50			163	26	10,293	260	11,079	462
18	366	61	86	29	47	16	14	3		130	43			163	26	10,293	260	11,034	438
19	351	59			47	16	14	3		118	40			163	26	10,293	260	10,927	404
20	354	59			47	16	14	3		119	40			163	26	10,293	260	10,931	404
21	336	56			48	16	14	3		119	40			163	26	10,293	260	10,914	401
22	333	56			48	16	14	3		105	35			163	26	10,293	260	10,904	396
23	342	57			48	16				109	37			163	26	10,293	260	10,901	396
24	231	39			49	17				86	29			163	26	10,293	260	10,779	371
25	40	7								26	9			163	26	10,293	260	10,509	302
26										17	6			163	26	10,293	260	10,465	292
27										12	5			163	26	10,293	260	10,462	291
28										12	5			163	26	10,293	260	10,462	291
29														163	26	10,293	260	10,458	286
30														163	26	10,293	260	10,458	286
31														163	26	10,293	260	10,458	286
32														163	26	10,293	260	10,458	286
33														163	26	10,293	260	10,458	286
34														163	26	10,293	260	10,458	286
35														163	26	10,293	260	10,458	286
36														163	26	10,293	260	10,458	286
37														163	26	10,293	260	10,458	286
38														163	26	10,293	260	10,458	286
39														163	26	10,293	260	10,458	286
40														163	26	10,293	260	10,458	286
41														163	26	10,293	260	10,458	286
42														163	26	10,293	260	10,458	286
43														163	26	10,293	260	10,458	286
44														163	26	10,293	260	10,458	286
45														163	26	10,293	260	10,458	286
46														163	26	10,293	260	10,458	286
47														163	26	10,293	260	10,458	286
48														163	26	10,293	260	10,458	286
49														163	26	10,293	260	10,458	286
50														163	26	10,293	260	10,458	286
<b>TOTAL</b>	7,091	1,224	1,877	743	753	332	274	57	2,100	2,823	998	16,137	407	8,109	1,287	501,528	12,844	538,575	17,892

Notes: 1) This table lists inbound carload and train totals; multiply by 2 for round trip data. 2) These numbers represent mid-range estimates for commercial, shared-use traffic.

## 4.0 Train Types and Traffic Projections

### 4.3 GROSS TONNAGE SUMMARY

During the approximately 25-year shipping campaign for SNF, DOE-related tonnage on the rail line (including rail cars loaded or empty, and locomotives) is approximately 13.5 million gross tons. This tonnage is based on the number of trains and assumed gross tons per train type and equates to an average of 542,000 gross tons per year. As a basis for comparison, the UPRR Caliente Subdivision handles approximately 40 million gross tons annually (Ladd 2000). Thus, the total DOE related traffic annual gross tons equals about 1.4 percent of the annual gross tons handled on the UPRR Caliente Subdivision.

The NRL, including commercial tonnage, over the same 25-year period would handle about 57.3 million gross tons, or an average of 2.3 million gross tons per year. The commercial tonnage is based upon the mid-level projections developed by Wilbur Smith Associates for Nye County (WSA 2005). Over a 50-year period, the rail line would handle about 105 million gross tons, including DOE and commercial traffic. This equates to about 2.5 years of traffic on the UPRR Caliente Subdivision. Commercial traffic, should it develop, constitutes an overwhelming percentage of the gross tons handled on the line. Further details concerning tonnage are presented in Appendix B.

Table 2 presents a summary of projected yearly gross tons on an incremental basis over the 50-year project life. Years 1 through 21 are shown in five year increments; differing periods are used thereafter. DOE-related traffic includes SNF, HLW, Navy, SSC/WP, repository construction materials and fuel oil.

**Table 2. Nevada Rail Line Annual Gross Tons**

Year	Gross Tons (millions)	DOE-related Traffic		Commercial Traffic	
		Gross Tons	Percent	Gross Tons	Percent
1	1.2	420,794	34	833,102	66
6	2.6	746,307	28	1,877,500	72
11	2.6	733,445	28	1,877,500	72
16	2.4	491,360	21	1,877,500	79
21	2.2	362,909	16	1,877,500	84
25	1.9	66,468	3	1,877,500	97
29-50	1.9	29,145	2	1,877,500	98

As indicated above in Table 2, the percentage of projected commercial traffic is consistently over half the traffic on the NRL during the first six years, is in the 70 percent range the next 15 years, and in the 80 to 98 percent range for the remaining 29 years.

### 5.1 ESTIMATED END-POINT TO END-POINT RUNTIMES

The design objective is to provide a transit time between the Caliente area and the end-of-line (EOL) site within a continuous 10-hour period (BSC 2005a).

Achieving an expeditious running time is a critical element of the cost of operating the railroad. The FRA hours of service regulations (49 Code of Federal Regulations [CFR] 228) limit train and engine crews to 12 hours on duty. If the operating characteristics do not permit one crew to move a train across the line comfortably within the allotted time, a second crew is required. Of further consideration is that the crew must go on duty in advance of the train's departure, thus consuming some of the allotted 12 hours of service time.

Getting a train over the line with a single crew is substantially cheaper than using two. Operating with two crews means that additional fringe benefits would be paid the additional employees. There would likely be a need for a crew change facility at an intermediate point on the line. Building, operating and supplying such a facility in a remote location represents costs that are better avoided.

Computer simulations (train performance calculations [TPC]) were used to estimate the run times of trains over the CRC route. TPCs use train route characteristics (route length, gradient, and curvature, etc) and train characteristics (locomotive tractive effort, tonnage, braking, etc) to determine the theoretical run time over the route for a particular train. At the writing of this report, many alternative routes are possible for the CRC. For the TPC data presented herein, a group of route segments were selected to serve as the basis for analysis alignment so that train performance could be estimated. The basis for analysis alignment is presented in Figure 1, found in Section 1.0 of this report. This alignment is about 331 miles long.

A six-car cask train (including two buffer cars and an escort car) was used in the simulations. This train has a trailing weight of approximately 1,821 tons. This train consist was selected to evaluate the upper limit capabilities of a cask train powered by two locomotives, especially if one locomotive becomes inoperable during the trip. Cask trains of up to 12 cars are being considered, but additional locomotives would be needed for these trains. Two locomotive cask trains could vary between one and six cask cars. Three-car cask trains may become the most common train consist.

Two runs of a six-car loaded cask train were simulated from Caliente to the EOL facility. The consist of each train was identical, two 4,000 horsepower (hp) locomotives, a buffer car, six cask cars, a buffer car, and an escort car. In the first case, both locomotives were operative; the resultant theoretical runtime was six hours and 57 minutes (6:57), with an average speed of 47 mph. In the second case, the run was made with one locomotive inoperative. This run was to test and verify that one locomotive was capable of pulling the train over the route in case the other locomotive failed. Operating with one locomotive, the six-car cask train took 9:23 with an average speed of 35 mph. In both cases, the run time assume no opposing train traffic. The performance of both trains is illustrated in Figure 2, speed-distance plot.

Two similar simulations were run for empty six-car cask trains traveling between the EOL facility and Caliente. The results for the train having two operating locomotives was a transit time of 7:22 with an average speed of 45 mph; and for the train with one operating locomotive, the transit time was 9:02 with an average speed of 36 mph. The performance of these trains is illustrated in Figure 3.

In the same manner, loaded and empty runs were simulated for the Navy 6 car cask trains. For the westbound loaded trains, the train with both locomotives operating had a transit time of 6:57, at an average speed of 47 mph, while the train having one operating locomotive had transit time 11:00 at an average speed of 30 mph. The performance of these trains is illustrated in Figure 4.

## 5.0 Train Movements

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For the return empty movement between the EOL facility and Caliente, the Navy cask train with both locomotives operating had a transit time of 7:55 at an average speed of 42 mph, while the train having one operating locomotive had a transit time of 10:46 at an average speed of 31 mph. The performance of these trains is illustrated in Figure 5.

It should be noted that loaded DOE and NAVY cask trains operating with one locomotive were in the 10 mph to 20 mph speed range a number of times lugging up hill. This type of operating approaches the maximum performance limits for the locomotive and under adverse rail adhesion conditions (rain, snow) there is the possibility that the train could stall.

The next set of simulations tested the performance of a 5,320-ton ballast train powered by four and three locomotives. As before, the loaded run was from Caliente to EOL and the empty run (1,320 tons) from EOL to Caliente. The purpose of these runs was to give an indication of the performance for trains that could be used to support CRC and repository construction or shared use commercial trains. The loaded westbound train from Caliente powered by four locomotives took 7:22, with an average speed of 45 mph; the train with three locomotives took 8:11, with an average speed of 40 mph. The performance of these trains is illustrated in Figure 6. The empty return trip from the EOL to Caliente with four locomotives resulted in a runtime of 6:13 with an average speed of 53 mph, and with three locomotives it took 6:17, with an average speed of 52 mph. It should be noted that the railroad alignment is designed to support 60 mph operations, thus the speed of the return empty train exceeded that of the empty cask trains, which are limited to a maximum speed of 50 mph. The performance of these trains is illustrated in Figure 7.

It should be noted that TPC represents a theoretical performance, that is, the maximum (perfect) performance is presented. In actuality, locomotives may not perform to peak efficiency, train engineers vary in train handling skills, and enroute delays may occur, such as those caused by bad weather. Therefore, actual runtime would be somewhat longer; typically a 7 percent pad is incorporated into scheduling to allow for such variances. This does not include delays due to meeting trains, slow orders for track maintenance, mechanical breakdown or other similar causes. For example, a runtime of about 7:30 is more realistic for the loaded six car cask train with two operating locomotives than the theoretical TPC time of 6:57.

An additional consideration that has not been assessed is train braking. The unique configuration and gross-weight of the cask cars (not yet designed) leaves braking as an undefined issue that would be analyzed in the future, and may impact the operational aspects identified in this document.

Speed--Distance Plot

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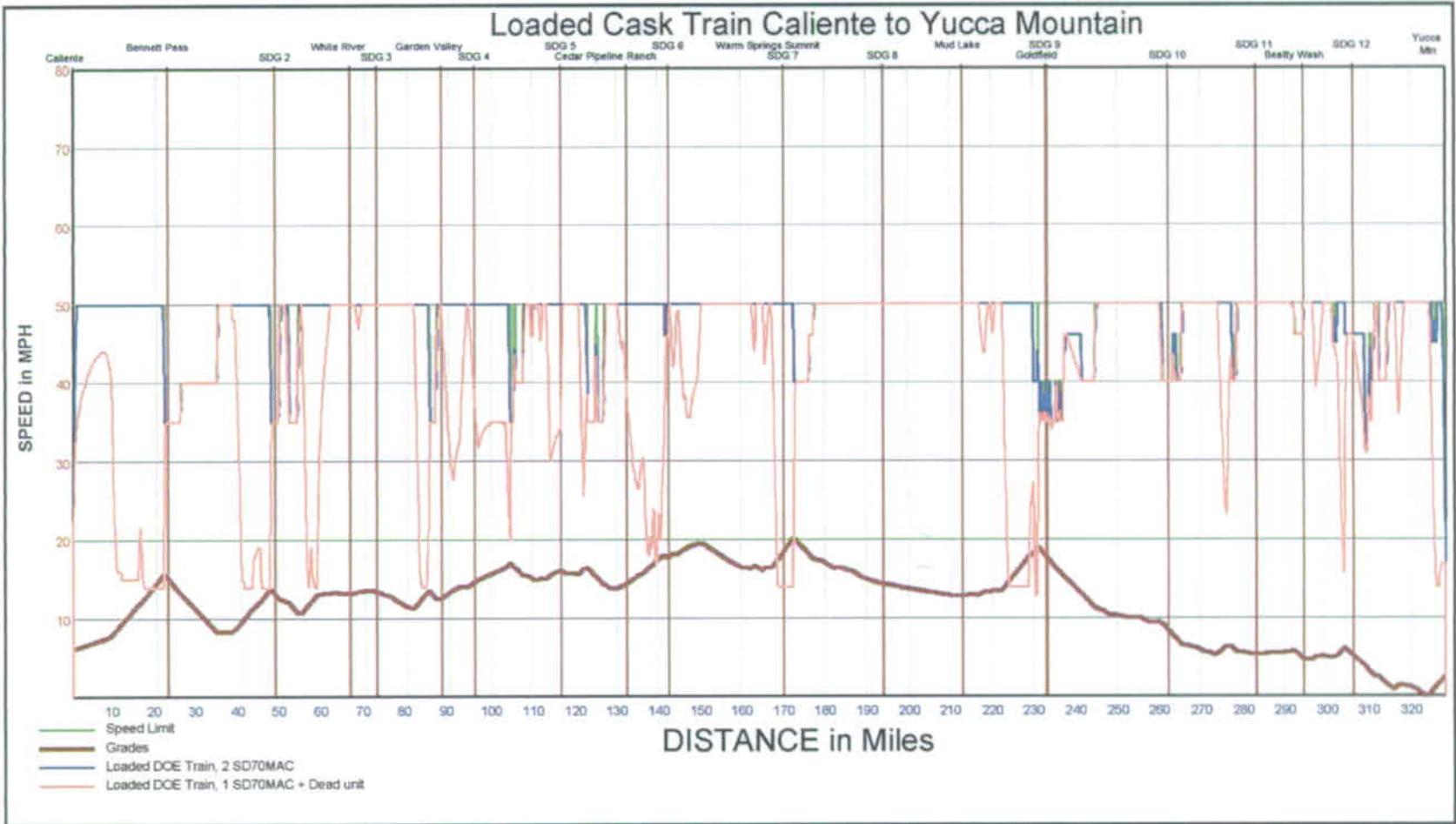


Figure 2. Loaded Cask Train, 1,824 Tons, Caliente to Yucca Mountain

Speed-Distance Plot

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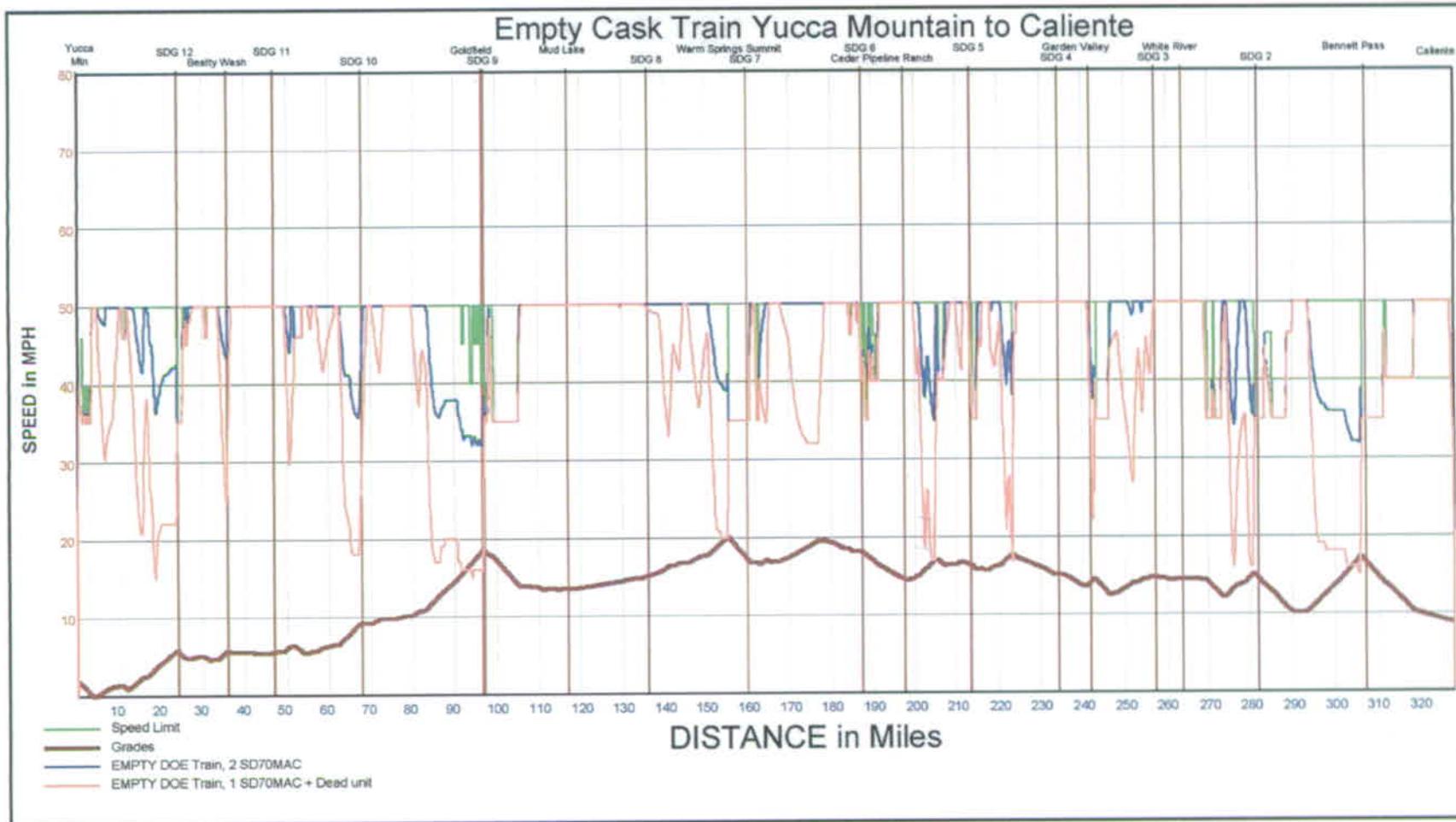


Figure 3. Empty Cask Train, 1,584 Tons, Yucca Mountain to Caliente

Speed-Distance Plot

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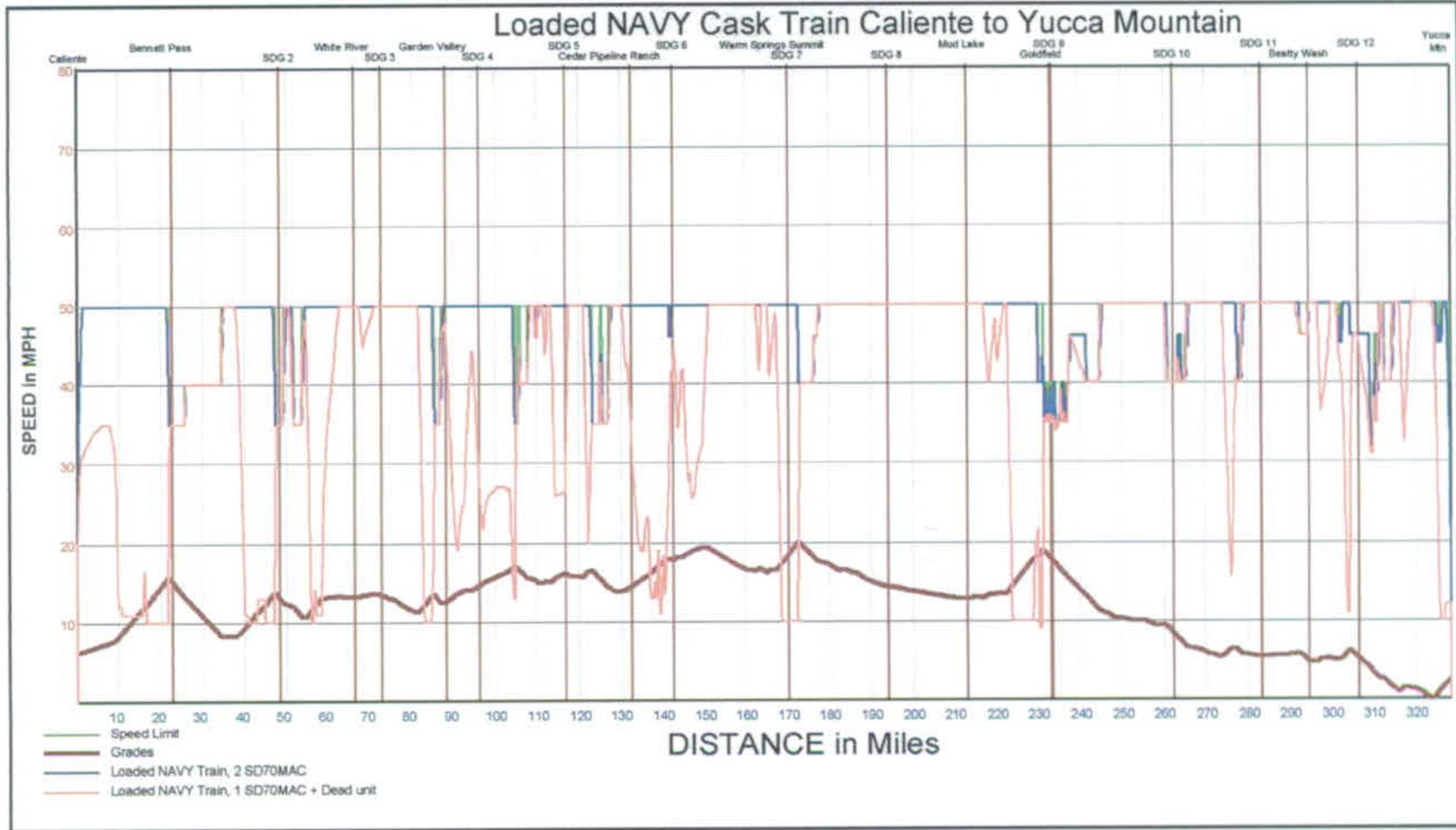


Figure 4. Loaded Navy Cask Train, 2,815 Tons, Caliente to Yucca Mountain

Speed-Distance Plot

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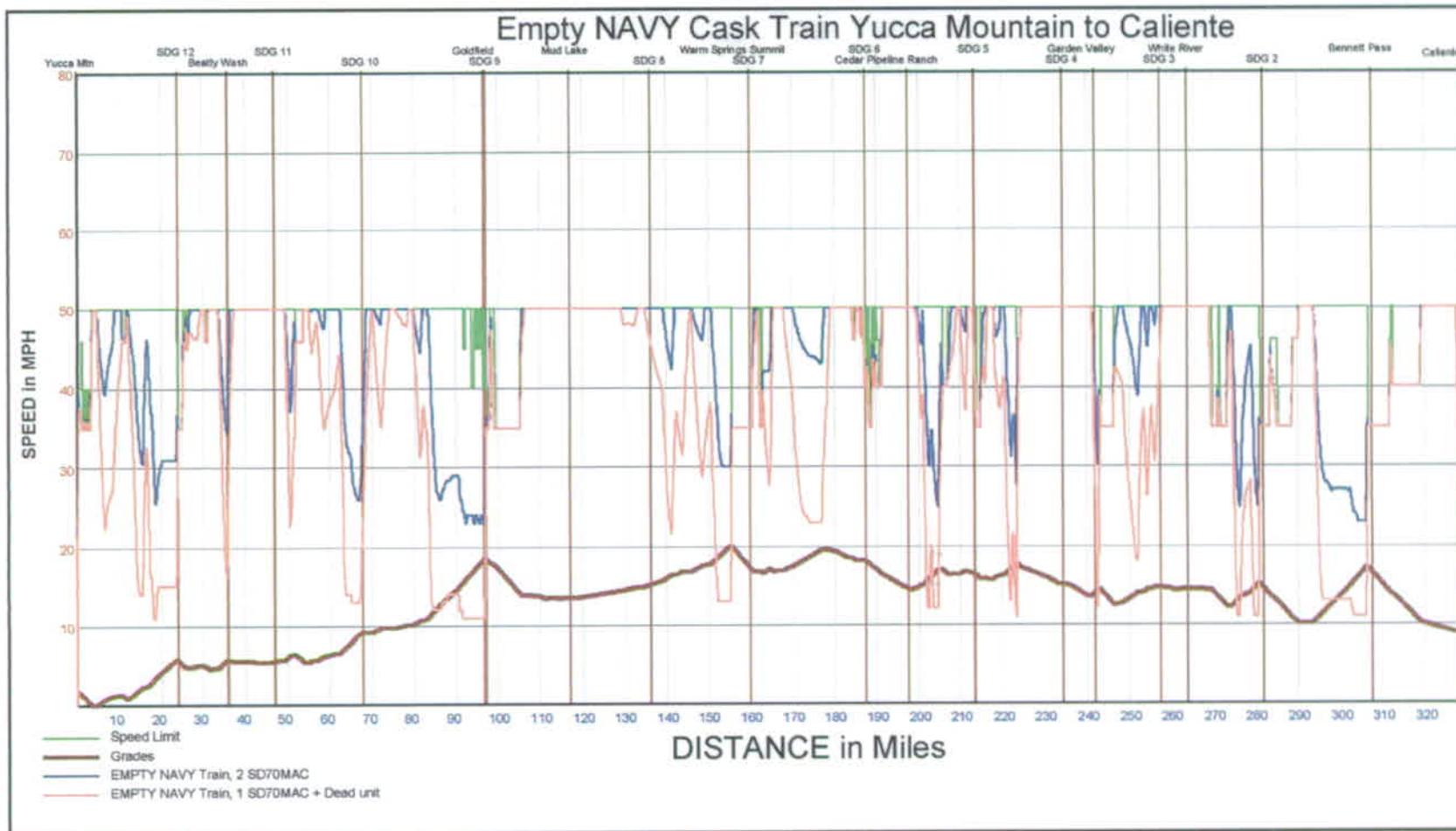


Figure 5. Empty Navy Cask Train, 2,607 Tons, Yucca Mountain to Caliente

Speed-Distance Plot

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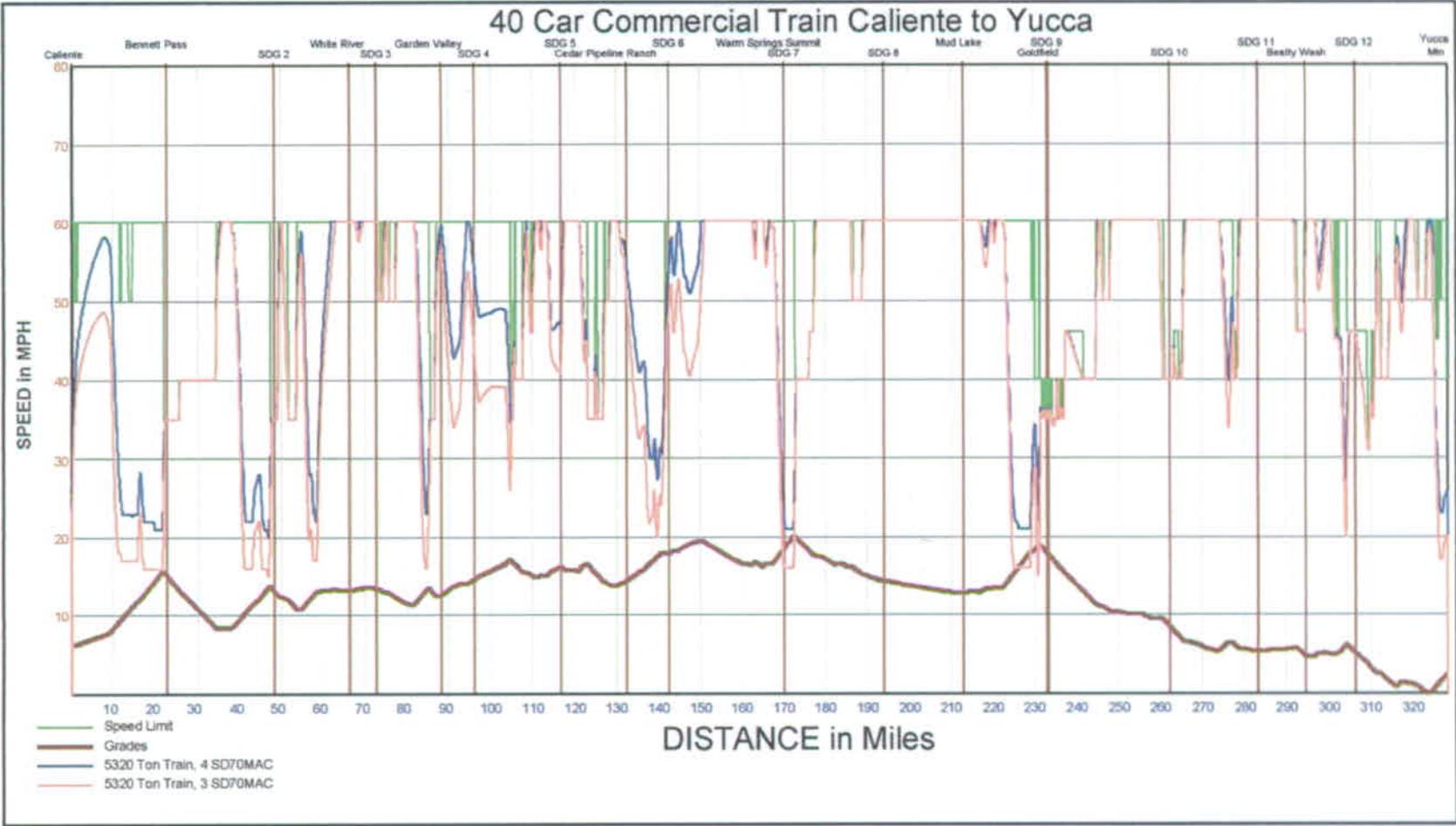


Figure 6. Loaded Ballast/Commercial Train, 5,320 Tons, Caliente to Yucca Mountain

Speed-Distance Plot

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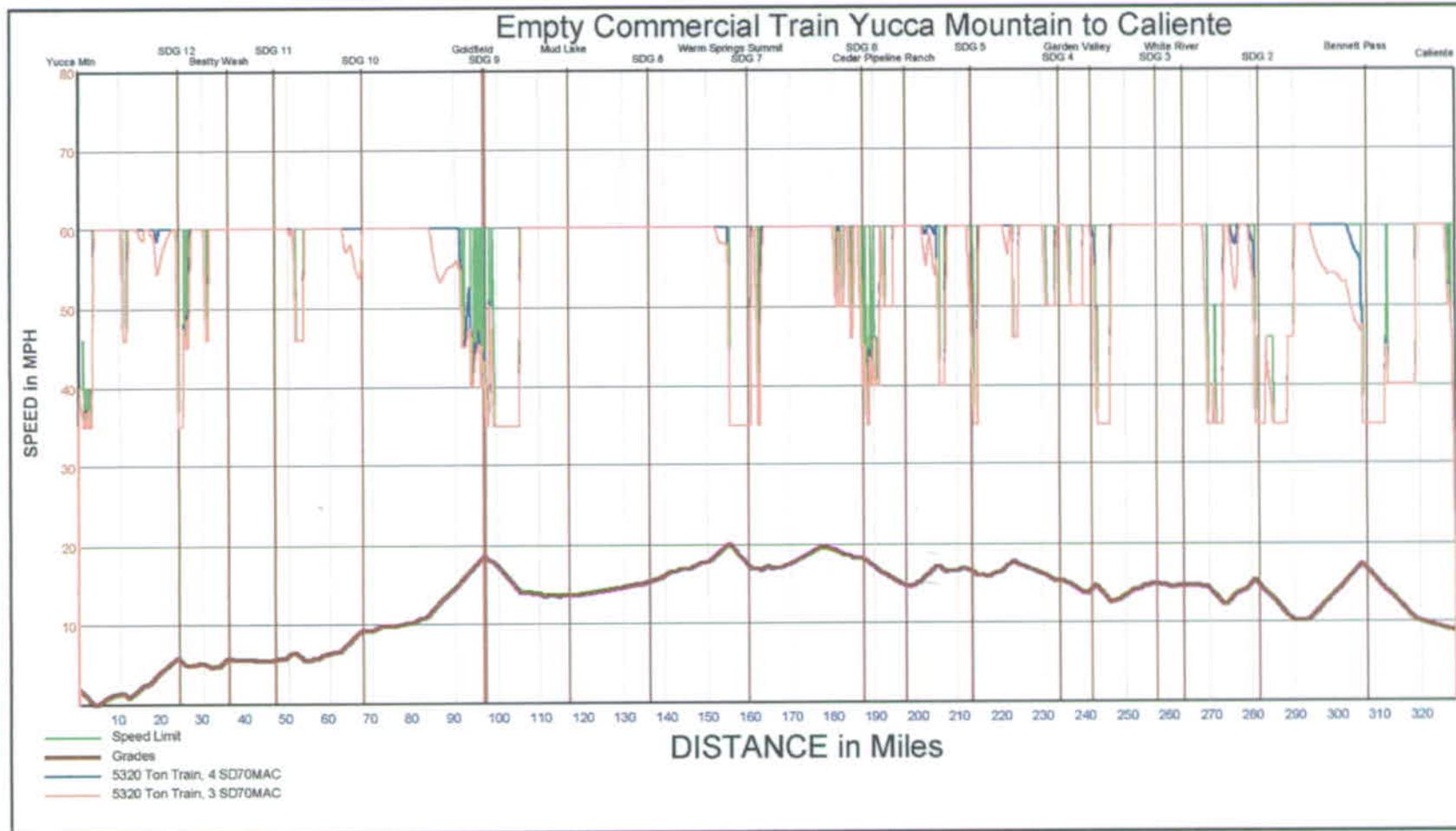


Figure 7. Empty Ballast/Commercial Train, 1,320 Tons, Yucca Mountain to Caliente

### 5.2 TRAIN CHARACTERISTICS

Trains hauling up to 12-cask cars are being considered. Assuming buffer cars separate the 12-cask cars from the locomotive and escort car, this train would be approximately 1,483 feet long. At the writing of this report, it is postulated that a 12-car cask train would happen infrequently, and a six-car cask train, described below in Table 3, is more likely. All trains having loaded casks of SNF/HLW would operate over NRL as a dedicated train with a minimum of two road locomotives on the head end. A six-car cask train (nine cars) would be approximately 943 feet long. Some other nominal train lengths estimated for NRL include; repository fuel train, 760 feet; and waste disposal container train, 410 feet; and ten-car Nevada Test Site shipment train, 760 feet.

Table 3. presents the expected characteristics of cask train cars.

**Table 3. Characteristics of Cask Train Consists**

Component	Weight	Length	Number
Locomotive	140 to 180 metric tons	23 meters	2 to 3
	(154 to 198 tons)	76 feet	
Typical cask and cask car	240 metric tons	18 to 27 meters	1 to 5
	(264 tons)	(59 to 89 feet)	
Naval cask and cask car	355 metric tons	18 to 27 meters	1 to 12
	(390 tons)	(59 to 89 feet)	
Buffer car	72 metric tons	18 meters	2
	(79 tons)	(59 feet)	
Escort car	72 metric tons	24 meters	DOE Trains: 1
	(79 tons)	(79 feet)	Naval Trains: 1 to 2

#### 5.2.1 Caliente Rail Corridor Alignment

The proposed alignment between Caliente and the GROA ascends and descends several mountain ranges on track gradients in the 1.5 percent to 2 percent range. The amount of heavy-grade territory for the CRC has been estimated to be roughly 40-45 miles in length or about 14 percent of the nominal 331-mile distance. If the assumption is made that it is unlikely that cask (or any other) trains would be able to maintain a 50-mph operating speed over the entire alignment, then a minimum operating speed of at least 20 mph is required over the heavy grade territory so that a cask train could cover the distance between the staging yard and EOL within 8 hours. (331 miles minus 45 miles = 285 miles/50 mph = 5.7 hours, then 45 miles/2.25 hours = 20 mph). Designing the system for an 8-hour run-time provides two additional hours over the ten-hour goal trip time (BSC 2005a). This provides additional train crew operating time that may be needed at either terminal to handle the placement of the locomotive consist onto the train, for performing and meeting the air-test requirements, for meets/passes, and to operate over temporary slow orders.

While the CRC alignment may have ascending and descending grades that appear steep, there are many locations on the national rail network with similar grades and curves. Some examples include: the 10 miles of 2.25 percent grade on the Burlington Northern Santa Fe (BNSF)--Northern Tier Transcon, in the State of Washington, and on the UPRR network in the Blue Mountains near La Grande, Oregon. Both BNSF and UPRR negotiate grades between 2 percent and 3 percent for 20 miles climbing out of, or descending into, the Los Angeles Basin at Cajon Pass. For this reason, sufficient motive power should be assigned to either the six-car or the twelve-car design train consist to enable these trains to operate at a reasonable speed on both the CRC alignment as well as the national rail network.

### 5.2.2 Six-Cask Car Design Train

It is assumed herein, that the consist of most cask trains would be between one-and twelve-cask cars. DOE cask cars weigh 264 tons and a Navy cask car weighs about 394.5 tons. At the end of a cask train would be an escort car weighing approximately 79 tons. The locomotives and escort car would be separated from the cask cars by 79-ton buffer cars.

For a six-car DOE cask train, the total trailing tonnage would equal 1,824 tons, as follows:

Six-car cask (264 tons)	=	1,584 tons
Two buffer cars (79 tons)	=	160 tons
One escort car (79 tons)	=	80 tons
<hr/>		
Total weight	=	1,821 tons

With current industry practice frequently using trains of 8,000–10,000 tons, the tonnage of the cask train is considered moderate within the rail industry. However, the proposed gradients are considered to be heavy. Consequently, the proper choice of motive power becomes of the utmost importance in order to achieve the desired run-times on the NRL. An additional consideration that has not been assessed is train braking. The unique configuration and gross-weight of the cask cars (not yet designed) leaves braking as an undefined issue that will be analyzed in the future, and may impact the operational aspects identified in this document. As information, a three-car cask train would weigh 1,029 tons. Figure 8 depicts the general configuration of a six-car DOE cask train with buffer cars separating the locomotives and escort car from the cask cars.



Figure 8. General Configuration of a Six-Car Cask Train with Buffer Cars and an Escort Car

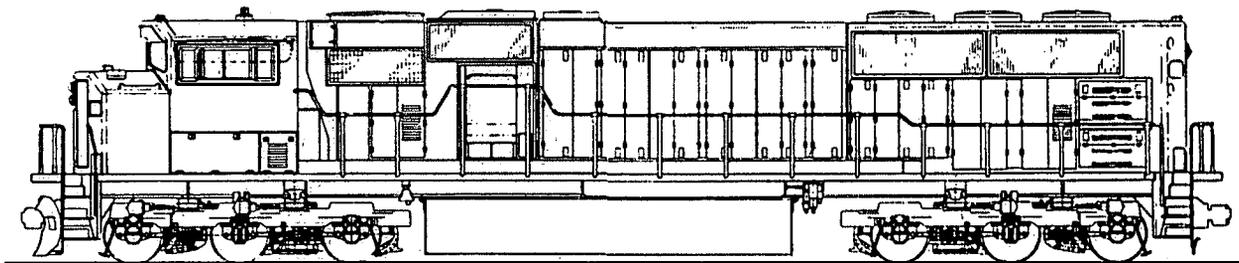
### 5.2.3 Road Power for Six-Car DOE Cask Train

The performance of various locomotives on sustained 2 percent grades was studied to determine the effect on overall runtime. Various analysis methods and data were used including formulas, associated tonnage charts, and estimating software furnished by one of the locomotive vendors, General Electric, through their "RightOnRails.com" software (GE Transportation 2006). Table 4 compares the performance of two locomotives (of four locomotive types) handling a six-car cask train (1,824 trailing tons) on a 2.0 percent grade. As can be seen in the Table 4, the 3,600 and higher horse power locomotives are capable of maintaining slightly above 26 mph speeds up the 2 percent grade. Two 2,000 hp locomotives are capable of handling a six-car cask train on the grade, but at a lower speed than the minimum 20 mph speed necessary to complete the run within 8 hours.

**Table 4. Locomotive Performance Assuming Two Locomotives Operating on a 2.0 Percent Grade**

Locomotive	Balancing Speed	Manufacturer	Transmission	Axles	Horsepower
SD70MACe	26.8 MPH	EMD	AC	6	4,000
C39-8	26.4 MPH	GE	AC	6	3,900
SD-45	24.4 MPH	EMD	DC	6	3,600
GP-38	14.7 MPH	Rebuilt	DC	4	2,000

Figure 9 presents a profile of a typical 4,000 hp road locomotive.



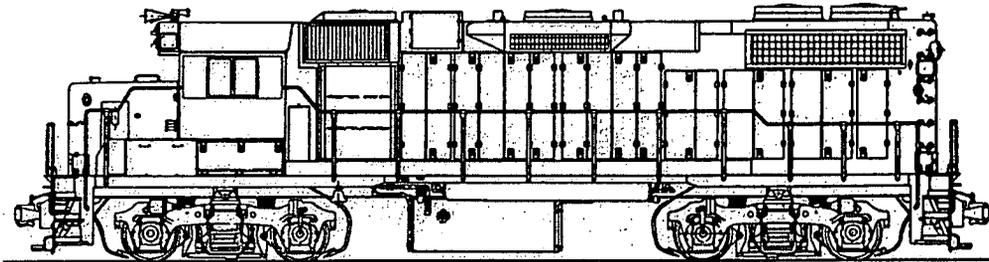
**Figure 9. Profile of Typical 4,000 hp Locomotive (SD-70MACe)**

### 5.2.4 Maximum Cask Train Length

The design of the CRC track and bridge structures do not restrict the maximum length of cask trains; however, the safe movement of cask trains requires that each train meets the hp/ton requirements as discussed in the previous sections. See Appendix F for a discussion of railroad bridge structure loading. Also, coupler strength must not be exceeded.

### 5.2.5 Switching Locomotives for Local Yard Work

Six-axle type locomotives are intended for long-haul movement of trains and are not particularly well suited for switching assignments. To handle day-to-day switching and assembly of trains, to switch rail cars to and from the GROA and the cask maintenance facility (CMF), and to handle "light" duty work assignments, four axle locomotives in the 2,000-3,000 hp range, such as a GP-38, B23-7, GP49, U30B, GP-40 or comparable model, are preferred. Figure 10 presents a profile of a GP-38 (2,000 hp) type locomotive.



**Figure 10. Profile of a GP-38 Type Locomotive**

### 5.3 SIDING SPACING

As noted earlier, the performance objective for the NRL is to have a practical transit time of eight hours, leaving four hours before the train crew must go off duty in compliance with FRA Hours of Service Law limit of 12 hours (BSC 2005a). Thus, potential delays enroute are very important considerations in order to maximize train crew utilization. Due to the single track configuration of the NRL, one common delay to be expected is for a train to wait in a siding to meet an opposing train. A siding is a short section of railroad track connected by switches with a main track. Although there are no specific criteria for specifying siding spacing, it is readily apparent that any frequently occurring wait over four hours would result in the train crew's time expiring under the FRA Hours of Service Law. If this happens, the train must stop and the train crew must be replaced with a new crew. Because of the remoteness of the route, crew replacement could take several hours.

Considering the 331-mile length of the route and the necessity of getting the train crew across the railroad in 12 hours, a siding spacing of about a one hour maximum wait time is a reasonable compromise between transit time objectives and the construction cost of sidings.

TPC runs were made to determine the approximate number and location of sidings. This was accomplished by running a loaded cask train from the staging yard located at Caliente Indian Cove to the EOL facilities and seeing where empty cask trains, departing every hour in the opposite direction, would meet the loaded cask train. This resulted in 14 potential sidings being located an average of about 23 miles apart. The graphical presentation of the siding locations is presented in Appendix D.

The initial locations of these 14 sidings were then evaluated considering the following factors:

- excessive running time to adjoining sidings (goal, maximum one hour)
- presence of at-grade highway/road crossings (trains can not be stopped where they block crossings)
- difficult terrain that would require bridges, high fills, long cuts, etc.
- difficult starting conditions for a stopped train (steep upgrade and sharp curvature)
- road access (accessibility to turnouts and signaling equipment, and to trains for running repairs, re-crewing, or incident recovery)
- ability to extend the siding for future needs

As a result of this evaluation, 12 siding locations have been identified and are listed in Table 5. The two factors limiting siding location proved to be constructability and gradient. Siding length would be a minimum of 7,000 feet in order to accommodate a maximum train length of about 5,200 feet. This siding length is necessary to accommodate materials trains during the construction of the rail line. However, as

## 5.0 Train Movements

noted in Table 5, siding lengths range between 7,000 and 12,000 feet. Again, these lengths are necessitated by engineering and train operations factors.

**Table 5. Siding Locations**

Siding	Milepost	Length (feet)
1	22.8	8,000
2	48.0	10,000
3	73.0	7,000
4	96.0	7,000
5	117.0	7,000
6	143.0	7,000
7	170.0	9,000
8	194.0	7,000
9	233.0	12,000
10	263.0	10,500
11	283.0	7,000
12	307.0	7,500

### 5.4 WEEKLY TRAIN OPERATIONS

Figures 11, 12, and 13 present a theoretical characterization of a week's train movements over the CRC system in the 2<sup>nd</sup>, 10<sup>th</sup>, and 20<sup>th</sup> years of operation. The 10<sup>th</sup> year reflects the highest yearly train count projected for CRC and is based on the projections presented previously in Table 1. For the sake of illustration, the commercial trains are run to the EOL facilities; however, in actual practice, they would probably go to a destination short of the EOL facilities

Trains projected in the tables portray round trip movements. As no schedule exists for the train movements, the departure day and time for each train was selected randomly. It is emphasized that the figures are meant to portray a conceptual characterization of a week's train random movements for the years indicated and is not a rigorous analysis. However, the figures do indicate some important trends:

- There are some long periods of no mainline train activity
- Movements tend to bunch

Concerning meets:

- There is no discernable location pattern for meeting trains (i.e., a specific location for priority siding locations cannot be identified)
- The week in the 2<sup>nd</sup> year had 5 meets, 2 involving loaded cask trains
- The week in year 10<sup>th</sup> year had 4 meets, 1 involving a loaded cask train
- The week in year 20<sup>th</sup> year had 5 meets, 3 involving loaded cask trains
- There was one siding location (SDG 9) that had a total of four meets for the three weeks simulated, two in the week of year 2 and two in the week of year 20.
- SDG9 was the only siding that had two meets in any week.
- There were four sidings (SDG 2, SDG 3, SDG 11, SDG 12) where there were no meets

Yucca Mountain: Weekly Train Activity

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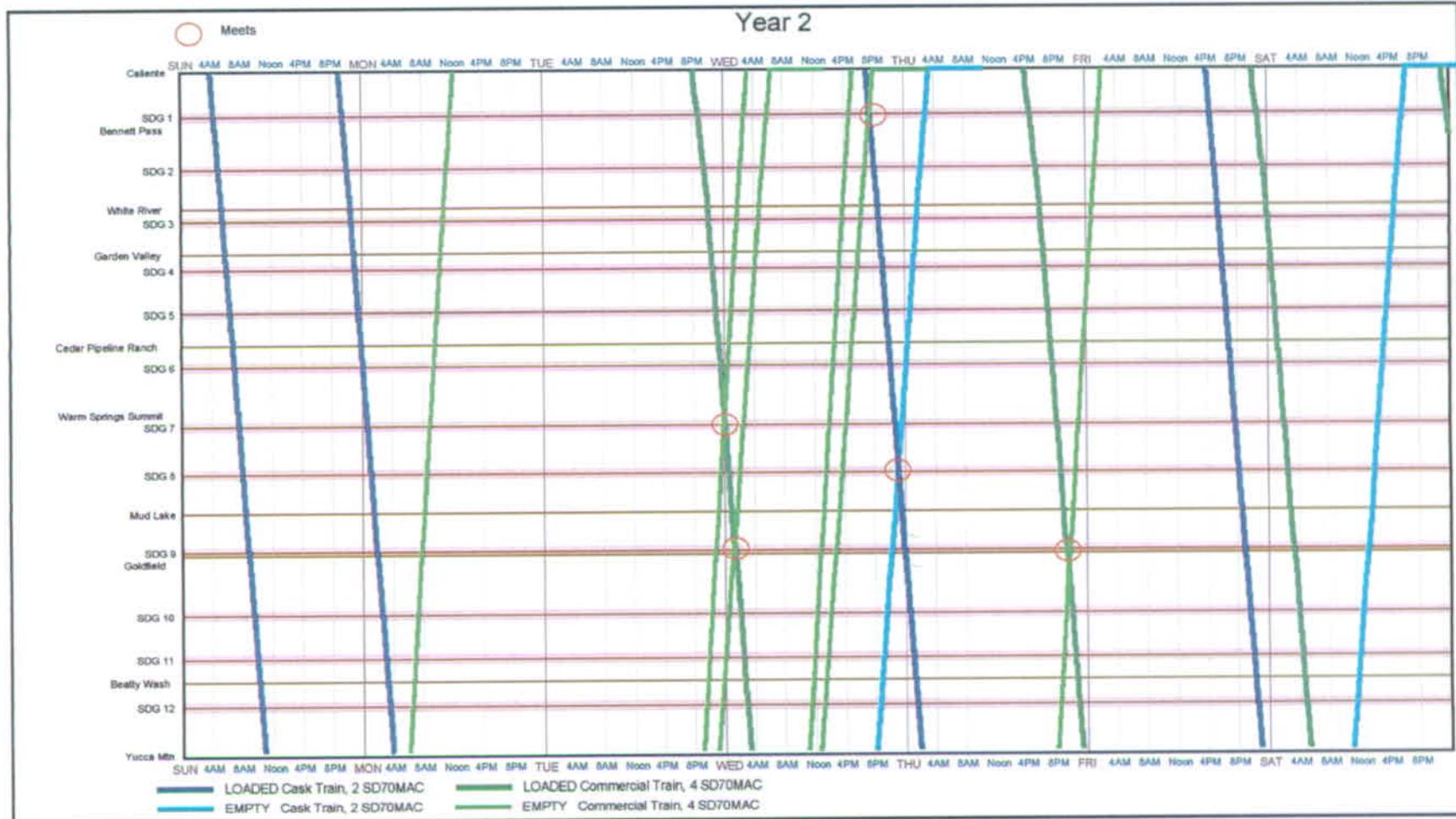


Figure 11. Train Activity – Random Week-Year 2

Yucca Mountain: Weekly Train Activity

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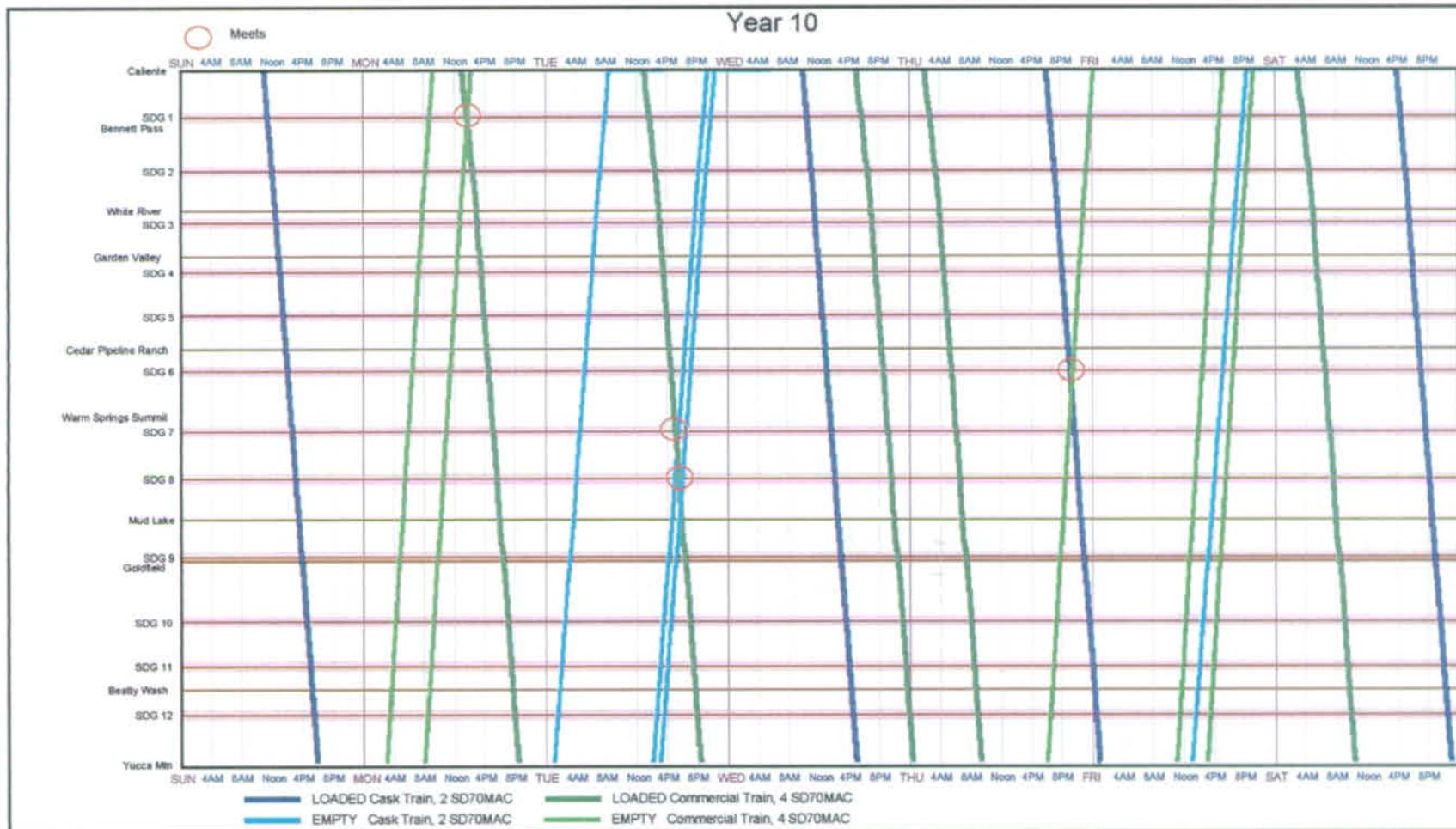


Figure 12. Train Activity – Random Week-Year 10

Yucca Mountain: Weekly Train Activity

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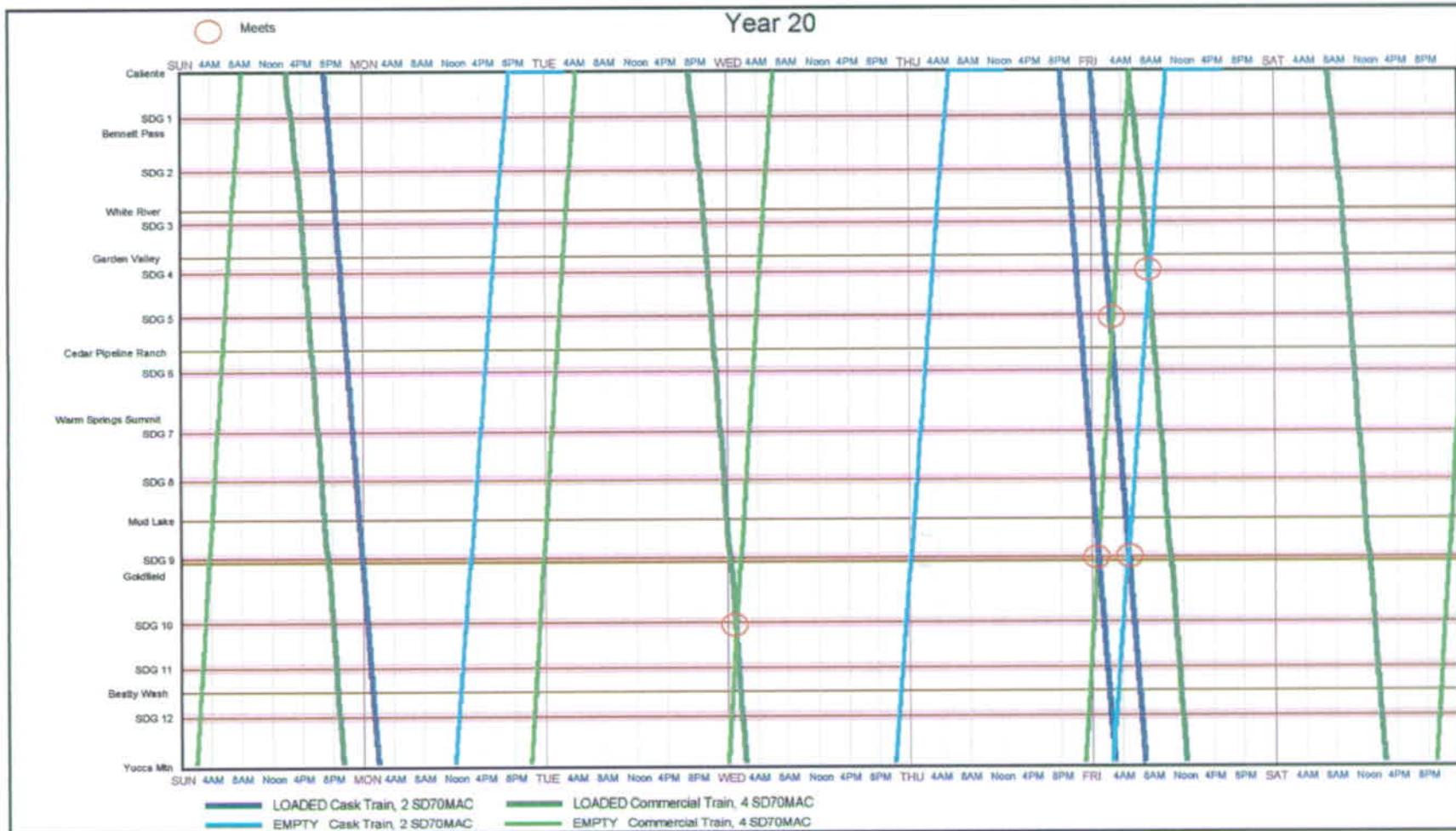


Figure 13. Train Activity – Random Week-Year 20

As noted in Section 5.1 of this report, it is a possibility that three-car cask trains become the most common train consist. Additional analysis was completed to estimate the meets under this operating scenario. The 10<sup>th</sup> year was used as it reflects the period of heaviest traffic. It was found that a sample week in Year 10 had eight meets; of those, three involved loaded cask trains and commercial traffic, and one involved an empty cask train. The balance involved commercial/commercial or empty cask train/commercial meets. (The six-car cask train scenario had four meets, one of those involved a loaded cask train and a commercial train, the balance were commercial/commercial meets or empty cask train/commercial meets) It should be noted that these data are based on random train occurrences and would vary from week to week.

Regarding train meets, it may be argued that meets could be reduced by holding trains at end points, and releasing them so that meets would be closely timed. However, the overall fluidity of train movements would not benefit. It matters little to fluidity if a train is held in a yard or on a siding. However, while the train is held in a yard, a train crew is not needed on duty.

### 5.5 ROAD LOCOMOTIVE UTILIZATION

Based on the random weekly train movements for Years 7 through 14 (eight cask trains and 10 to 12 other trains, including commercial shared use trains), a fleet of 12 road locomotives (two locomotives per train or six sets) are required to protect train departures on a no-terminal-delay basis. With modest revisions of a few hours earlier or later at the EOL terminal, the fleet requirement can be reduced to eight road locomotives (revised random eastbound schedules). These fleet sizes assumed no "light" engine movements; however, considering the random arrival of trains, it is likely that some deadheading may be necessary at some time. Deadheading is a nonrevenue repositioning move, where the locomotive makes a trip without cars or freight.

Considering DOE-only traffic (commercial trains are excluded); the fleet requirement is six locomotives, three sets of two locomotives (Random schedule DOE trains [without commercial trains]).

Table 6 below, summarizes locomotive fleet requirements and utilization.

**Table 6. Summary of Locomotive Requirements and Utilization**

Operating Scenario	Trains per Week	Road Locomotives	Utilization Rate
Random schedule	19-20	12	15
Revised random eastbound schedule	19-20	8	27
Random schedule DOE Trains (without commercial trains)	8-10	6	15

In the revised random eastbound schedule, the scenario with the highest utilization rate, three of the four locomotive power sets make three round trips per week, while the fourth set makes one round trip per week. In the DOE-only scenario, each power set makes about 1.6 round trips per week. While this utilization may seem low, the six locomotives are needed to make sure that road power would be available to expedite cask train movements, locomotive deadheading is minimized, a spare locomotive is available when others undergo maintenance, and that units are available to make a three or four locomotive consist to power a GROA 4-5,000 ton construction train.

Considering the 12 locomotive utilization scenario, total annual locomotive miles are approximately 650,000; and 54,000 annual miles per locomotive. Considering the DOE-only scenario, total annual locomotive miles are approximately 343,200 miles and 57,200 miles per locomotive.

The above data assumes that locomotives are rotated to equalize mileage.

### 5.6 YARD AND MAINTENANCE-OF-WAY LOCOMOTIVE REQUIREMENTS

In the first few years of operations, at least one switching locomotive would be required at the staging yard and at the EOL yard. The switching locomotive at the UPRR interchange yard would pick up and deliver freight cars from the UPRR interchange tracks and handle other miscellaneous tasks such as sorting and classifying cars and positioning MOW cars. It is noted that cask trains to and from the UPRR would be handled by UPRR locomotives into and out of the staging yard.

The switching locomotive at the EOL yard would be used to move cars to and from the GROA, and other movements such as positioning fuel oil cars and GROA construction materials cars for unloading, and to make up empty cars into return trains.

An additional switch locomotive should be available for use on occasional MOW trains and as a spare in the event of servicing or break down to one of the other two switching locomotives. A fourth switching locomotive may be necessary to handle switching to and from the CMF. At this writing, the location and activities to take place at the CMF are not fully defined so switching requirements are uncertain.

## 6.0 Train Control and Communications

### 6.1 COMMUNICATION SYSTEMS – OPERATIONS

#### 6.1.1 Introduction

The NRL would operate utilizing the same communication intensive command and control structure employed by virtually all major North American railroads. This involves dispatch, operations, and management personnel interacting with each other at a single location called the train control center (TCC). These personnel utilize a complex set of management information systems to plan, execute, and otherwise manage the operation of the railroad on a long-term, short-term, and minute-to-minute basis. The communication system described herein is compatible with the requirements as stated in *Communications System Description Document* (BSC 2005b).

It is important to note that communication technology is in a period of rapid change. Therefore, design decisions made are based upon the assumption that the system would be deployed in the relatively near term. The forces of “technological change” and “economies of scale” could result in different decisions if the deployment is many years away. The conceptual designs presented here have been made with consideration of the requirements and constraints of the project and with consideration of anticipated technology and regulatory changes. If the deployment is significantly delayed, some of these issues may need to be reviewed.

Railroad operations require personnel conducting activities along the rail line, including train crews and maintenance crews that need the capability to interact with the personnel at the TCC. In addition, various systems that control and monitor the railroad must be located in the field in close proximity to the rail line and these systems must interact with the management information systems at the central TCC facility. Accordingly, high quality voice and data communications in sufficient capacity are essential to the safe, efficient and effective operation of the railroad.

It should be noted that although some communication infrastructure exists at various points along the line, because so much of the system is located in remote areas without infrastructure of any kind, there is a need for a fully integrated self contained private communication system. This approach is taken to assure availability of a complete system, while allowing for the possibility of leveraging other communication resources if deemed appropriate.

This global view of how the operating personnel and their supporting systems interact is depicted in Figure 14.

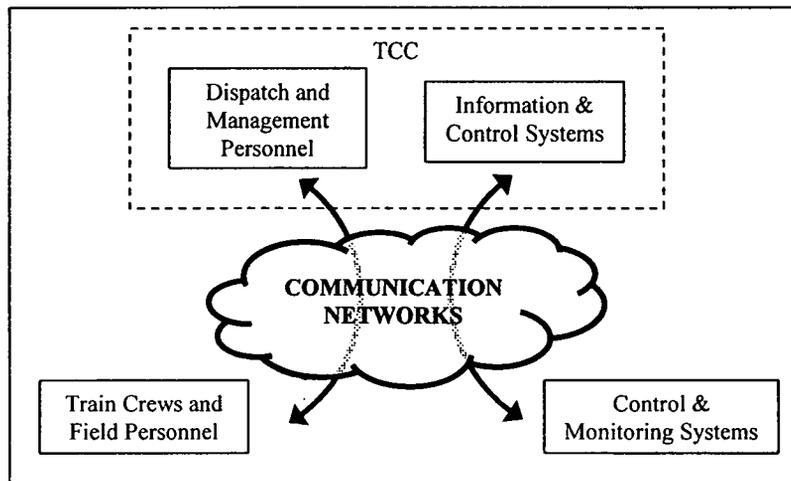


Figure 14. Global Interconnection Requirements

## 6.0 Train Control and Communications

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### 6.1.2 Guiding Principles

Efficient and effective operation of the NRL would require a number of specialized communication systems providing connectivity throughout the system with a high quality of service. Much of the NRL would be located in distinctly remote areas making effective communications not only an operating requirement but a safety requirement as well. Therefore, in undertaking the conceptual design, the following guiding principles are established for the analysis and design.

- Field personnel would have at least two independent and diverse methods for voice communications.
- Communication infrastructure would incorporate redundancy so that a single point failure would not incapacitate large portions of the system.
- Mission-critical applications would be segregated from non essential applications to eliminate the possibility of failure impacts of non essential applications.
- Because the alignment borders a significant U.S. Air Force operations area, the use of communication towers would be avoided where possible and where required would be limited to heights approved by the Federal Aviation Administration and the Federal Communications Commission.
- All equipment would be installed within the corridor as described in the environmental impact statement.

In accordance with these guiding principles, three general requirements that apply to all network system elements have been established as follows:

High Reliability - The communications networks are anticipated to support mission-critical and life-critical applications; they would be designed with at least carrier-class reliability. This level of reliability can entail: multiple routes in the network and a level of redundancy. Since the network is expected to be operational for many years, technologies would be utilized that are standardized and in widespread general use. They would utilize standardized interfaces so that new, commercial off-the-shelf equipment can be deployed in the future as necessary when manufacturers discontinue equipment at the end of product life cycles.

Security - The communications network architectures would be designed to support network security. Although the communications network is intended to be a private network, it would be designed with the appropriate data aggregation points that allow for interface with other Yucca Mountain networks if necessary through appropriate protective firewall technology.

Flexibility - Since additional applications for the communication networks may emerge in the future, the networks must be able to accommodate these additional requirements through incremental upgrades. Such changes may include: the addition of control centers, the addition of new remote equipment locations, and new software applications, etc. The network would be designed to be scalable to support many additional sites without the need for a complete network re-design. The new communications network must also be designed to support a variety of devices that may be attached to the periphery of the network such as switches, servers, telephones, wireless base stations, etc.

### 6.1.3 Communication System Conceptual Design

The communication system required to support railroad operations would utilize four distinct communication technologies: synchronous optical network (SONET) fiber optic backbone, very high frequency (VHF) land mobile radio, geosynchronous satellite dispatch radio, and potentially satellite

## 6.0 Train Control and Communications

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telephone. At the TCC, the system is configured to allow the dispatcher easy access to all of the various communication modes available including the ability to patch modes together if required.

Fiber Backbone - The communication mechanism used to provide the point to point connectivity is referred to as a "backbone". The function of the backbone, as the name implies, is to provide a common high speed communication medium along the right-of-way (ROW) that provides core connectivity for communication applications and for the control systems.

The fiber optic backbone has the capability to provide multiple dedicated communication circuits between any two add/drop multiplexers on the fiber ring. In the present case, communication circuits are primarily between the TCC and the remote sites that house radio base stations, signaled interlockings at grade crossings, and defect detection sites.

Telephone Service - In addition to housing equipment that enables the operation of the aforementioned communication modes, the TCC would also have a private branch exchange (PBX) telephone system. Standard voice-grade telephone service is provided via a commercial PBX. The PBX is connected to remote telephones located in the equipment houses and other locations along the railroad via the fiber optic backbone system. Some of these remote telephones simply appear as extensions on the PBX and can be direct dialed, and others are used as a hotline to the dispatcher. The PBX is also connected to the public switched telephone network (PSTN), which allows telephones on the system to access an outside line from the TCC and make calls as necessary.

VHF Land Mobile Radio - The North American railroads utilize VHF land-mobile radio to maintain voice communications with operating and maintenance crews. They share 96 VHF channels in the 160 megahertz band. Channel coordination is handled by the AAR and channels would be made available for the NRL. In general, these are simplex channels that operate in the clear.

The VHF land mobile radio system would consist of a series of base stations located at appropriate points along the alignment to provide full radio coverage. (Note: Full coverage is generally considered to be 95/95 or 95-percent coverage 95 percent of the time.) A mobile VHF radio is located in each locomotive and maintenance/management vehicle. Handheld walkie-talkie radios can be issued to personnel as necessary. The radio base stations would be connected to the TCC through the SONET network.

The VHF radio system is the primary link to field personnel and is configured to allow the dispatcher to make and receive radio calls to any remote personnel who is located in the coverage footprint of a radio base station. A radio controller is located at TCC that allows the dispatcher to select the particular base station/channel/frequency s/he wishes to use to make a radio call. The voice signal is sent to the remote base station via a virtual circuit on the fiber system and the base station broadcasts the message. The message can be heard by all personnel in range of a base station. A remote user such as a locomotive or maintenance crew transmits back to the base station which then transfers the voice signal back to the TCC via the fiber backbone. The radio controller at the TCC routes the voice to the proper console.

In the event of an incident along the NRL, the responding public safety agencies would utilize mutual-aid channels for local communications. Mutual-aid channels would be incorporated as necessary into the design of the VHF radio system for fire and emergency services, as well as for law enforcement. These additional transmitters and receivers would be located at the base station sites and the TCC would have the capability to patch and bridge the voice circuits that are associated with these channels as necessary for coordinated operations. The selection of the specific channel(s) would be coordinated with the U.S. Air Force as well as local agencies along the NRL service area.

Geosynchronous Satellite Dispatch Radio - In the event of a failure of all or part of the primary VHF radio system, operations would continue via a dispatch radio system based upon geosynchronous

## 6.0 Train Control and Communications

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satellites. At the geosynchronous altitude of 22,300 miles above the earth, the angular velocity of the satellite exactly matches the angular velocity of the earth. For this reason, the satellite appears to remain at a stationary point in the sky which allows for extremely large coverage area. The system would be constantly active, but would only be used extensively if there is an outage of the VHF radio system.

The geosynchronous satellite dispatch radio system provides a means to communicate without the need for any ground based infrastructure on the NRL other than the satellite radios themselves which are installed at the TCC, on each locomotive, and in each maintenance and management vehicle. Transportable versions could be issued to other personnel as necessary.

Satellite Telephone - As a tertiary back up scheme, it may be advantageous to utilize satellite telephone hand sets. These units consist only of the satellite telephones themselves and would be issued to personnel as required and in accordance with the operating plans. These systems operate in a manner analogous to terrestrial cellular telephone systems, with the distinction that the provider's equipment is orbiting overhead. From the user's perspective the operation is virtually identical to the cellular telephone model. The service provider's ground station interconnects to the PSTN, allowing calls to be made to telephones anywhere in the world from a satellite phone (including other satellite and cellular mobile phones).

### 6.1.4 Ground Based Infrastructure

In order to support the operations described, much of the fiber optic and radio equipment would be located along the NRL ROW. In general, these communications sites consist of an equipment room that houses the radio and fiber optic electronics and a monopole radio tower to hold the elevated antenna structure (monopole radio towers would be located about 10 to 20 miles apart along the rail line). For safety, the communication sites would be fenced.

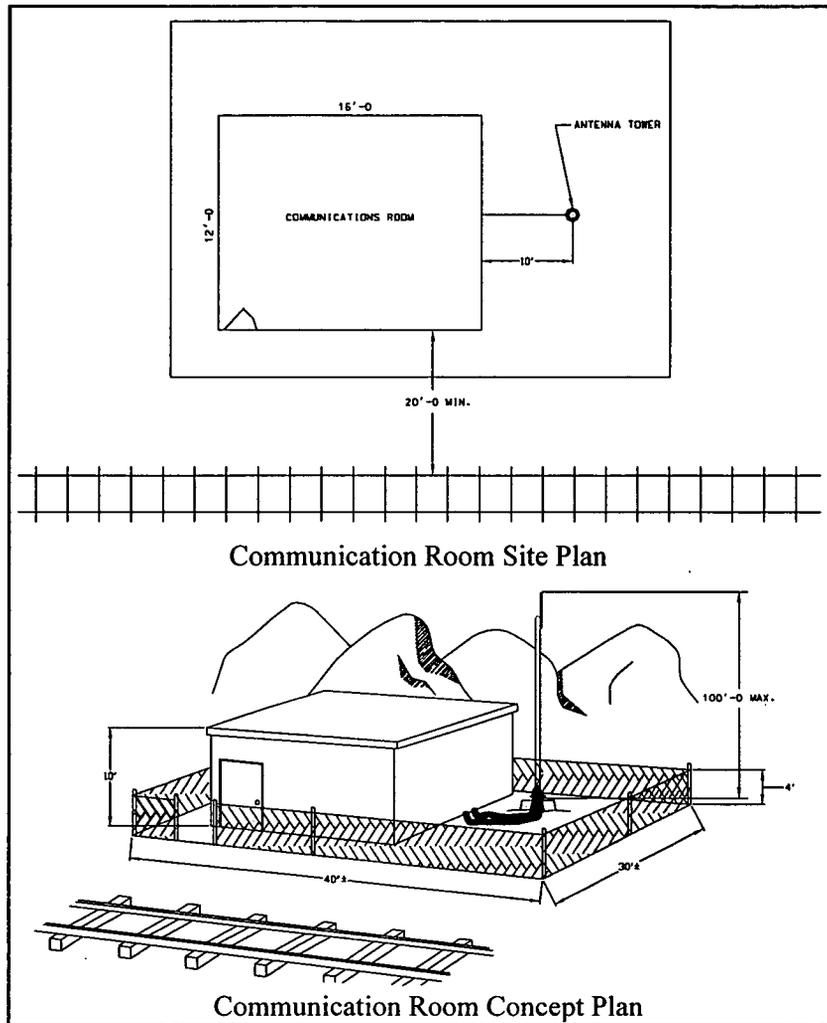
Figure 15 depicts a plan and elevation view of a typical remote communications location and Figure 16 is a photograph of an existing typical location that utilizes wooden pole structures. These facilities have been sized for potential future system expansion.

### 6.1.5 Ancillary Communication Services

It has been suggested that if a fiber-optic cable is to be laid the entire length of the rail line, it would be possible to bring connectivity to some relatively sparsely populated area that otherwise could not have internet access and related services.

Provision of this service is completely feasible because a separate and isolated fiber cable can be installed to facilitate this process without interference with critical NRL communication systems. If this option is implemented, it is recommended that the implementation model be based on a "dark fiber service" approach. With this approach, the railroad could make available spare fiber to a service provider that would provide the infrastructure on both ends. This is a win-win scenario since the railroad would be providing the element that is presently infeasible while remaining focused solely on railroad operations with no risk of ancillary services impacting railroad operations. (The service provider would handle the local equipment, last-mile connectivity, billing, and service, etc.)

## 6.0 Train Control and Communications



**Figure 15. Typical Remote Communications Location Concept Views**



**Figure 16. Typical Wooden Pole Structure**

### 6.1.6 Conceptual System Design

The communication configuration for operation of the NRL provides for: cost efficient operation; a robust highly reliable set of services; continuity of operations; and the ability for voice connectivity from the remotest parts of the system to virtually any telephone number in the world. The conceptual design is graphically depicted in Figure 17.

## 6.2 TRAIN CONTROL CENTER

Mainline train movements over NRL would be dispatched from a TCC. Train movements would be monitored on a real time basis with the capability of continuous communication between the TCC and all trains and other track mounted vehicles. All operating procedures would be in conformance with the General Code of Operating Rules (GCOR) (BSC 2005a). The TCC would also be responsible for calling train crews. In addition, the TCC would manage the integrity of NRL in terms of asset protection, including detection of broken rail, overheated wheel bearings, high wheel impact loads, dragging equipment, temperature extremes, high winds, seismic events, and other natural phenomena.

Yard movements at the EOL and interchange facility would be controlled by yardmasters at those locations. Yardmasters would have direct communication with the TCC to coordinate train arrivals and departures.

Operations on NRL would be coordinated with the National Transportation Operations Center (NTOC), the latter being responsible for the national tracking and scheduling of DOE-related train movements.

## 6.0 Train Control and Communications

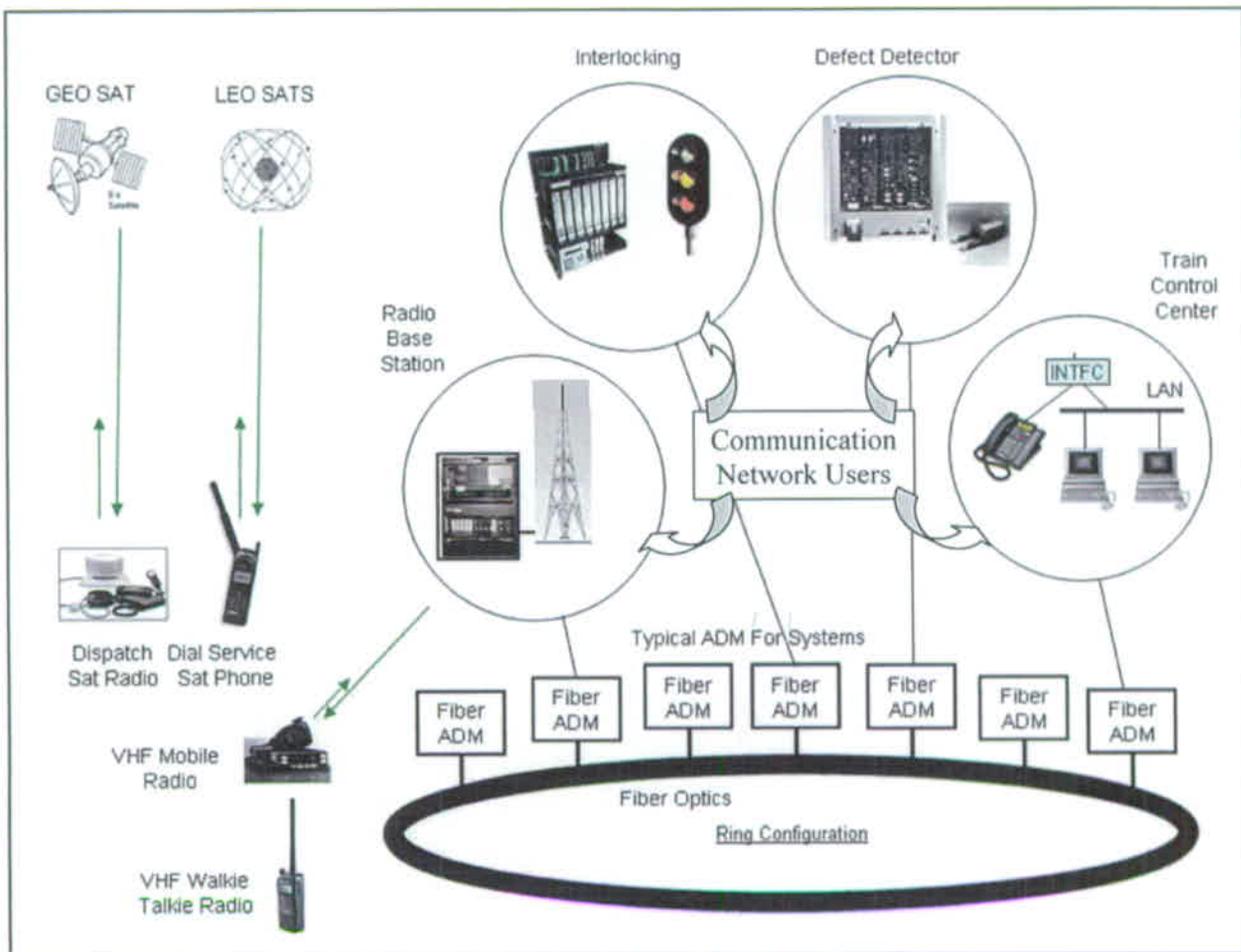


Figure 17. System Architecture for Operations

### 6.3 SIGNAL SYSTEM – CONVENTIONAL SIGNAL SYSTEM

A conventional signal system (CSS) would protect train movements for the entire length of the line. The particular CSS system selected for the NRL is the centralized traffic control (CTC) system. The CTC system would provide a vital signal system that would not allow the dispatcher to create an unsafe condition for the trains operating within the signal territory (i.e. trains operating on the same track in opposite directions). This safeguard is accomplished by signaling circuitry that prohibits a dispatcher from routing a train into an occupied track segment. The CTC system would also provide the dispatcher with the ability to protect MOW worker crews by blocking signals at each end of their work territory so that the signals cannot be cleared for train movement until the dispatcher coordinates activities with the MOW worker crews.

The CTC system includes wayside signals spaced about two to three miles apart for the entire length of the line. The wayside signals would be ground mounted with signal heads located back to back. This allows full vital signal system protection for trains operating in either direction. Interlocking control would be used at all end of siding locations and switches and would be electrically powered and remotely controlled by the train dispatcher. Track circuits would be required for the entire length of the line to detect track occupancy, transmit vital signal information, and provide broken rail detection.

## 6.0 Train Control and Communications

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The CTC system provides the ability for dispatchers to safely arrange and execute train passing maneuvers and to provide a secure location to place roadway worker crews. The CTC system would not enforce train speed limits or speed or temporary speed restrictions. It remains the train crews' responsibility to not violate the operating rules.

Train and infrastructure defect detectors alarm warnings would be incorporated into the TCC to stop trains if necessary due to the presence of a defect.

The CTC system architecture consists of the following systems:

- A dispatchers' control console to allow control of the signal and switches and a track model board so that indications of the signal and switches can be displayed to the dispatcher
- A wayside control house located at each powered switch location to control the signals and switches
- A wayside control case located at each wayside signal location to house the track circuit equipment and control the signals
- A data communication system to communicate between the wayside control houses and cases, and the central office where the dispatchers are located

### 6.4 ASSET PROTECTION

There are no CFR requirements to provide asset protection. Use and location of these devices would be based on American Railway Engineering and Maintenance-of-Way Associations (AREMA) guidelines (as available) and industry practices (BSC 2005a). There are several different types of train and infrastructure defect detectors. The following is a list of the different types of asset protection systems detectors available:

- Hot journal detectors (to determine if any wheel bearings are overheating which could cause the train to derail)
- Dragging equipment (to determine if damaged equipment or other object is dragging under the train which could damage the track structure or cause the train to derail)
- Impact detectors (to indicate a wheel is out of round or has flat spots. Wheels having these defects could shatter, or damage miles of rail due to excessive impacts)
- High and wide cars (to determine if any of the loads have shifted or in the case of a high and wide move, to confirm the train has the proper clearances to pass through areas with restricted clearance)
- Slide fence (to detect a landslide that may have fouled the track structure)
- High water (to determine water levels in high water run off areas so that the area can be checked to determine that the track or bridge structures remain safe for passage)
- Broken rail (to determine track integrity). A low voltage is introduced into the rails at one end of a circuit and received at the other. If the low voltage is not received at the other end, a broken rail may be indicated. The maximum length of this type of detection circuit is 18,000 feet. Note also, that a rail may break and the circuit remains intact, thereby not being detected. The system is not foolproof, but is a consequence of having a signal system and does add to overall operational safety.

In addition, NRL should subscribe to a seismic reading service.

### 6.5 HIGHWAY/RAILROAD AT-GRADE CROSSING WARNING SYSTEM

Federal and state highways along the route would be grade separated (BSC 2005a). Other railroad/highway public grade crossings would be evaluated on a case by case basis to determine appropriate safety measures, including the potential installation of grade crossing warning devices. Actions to be taken at private railroad/highway grade crossings would include passive warning devices having stop signs.

### 7.1 UPRR INTERCHANGE AND STAGING YARD OPERATIONS

The interchange track network consists of two separate track layouts: (1) the UPRR interchange, and (2) the staging yard. The UPRR interchange consists of a lead track and two interchange tracks located immediately adjacent to the UPRR main line. These tracks are where cars from the UPRR road freight trains would be placed for delivery to CRC or picked up from the CRC. There are two potential locations for the UPRR interchange, Eccles and Caliente.

The staging yard is where cars would be held and sorted into trains. A total of three potential locations for the staging yard have been identified: two at Caliente – Indian Cove and Upland – and one for Eccles, Eccles North.

Loaded inbound cask trains would proceed directly into the staging yard. There, the UPRR locomotives would be exchanged for NRL locomotives. The UPRR locomotives would either layover at the staging yard, couple on to an empty cask train (if available) or exit the staging yard with no train. There are no tracks in the staging yard designated specifically for cask cars or trains. Upon the completion of interchange administrative and car inspection procedures, estimated to take about 2 hours, the cask train would depart for the GROA. If radiological inspection of the cask cars is contemplated, the time for this inspection is not accounted for in the 2-hour interchange processing period. NRL road crews would be called for duty based on the estimated departure time of the cask train. Movement of the cask train through the interchange process is to be accomplished as quickly as possible.

Arriving general freight for the GROA (construction materials, fuel oil, site specific cask, waste packages, etc.) would arrive in UPRR road freight trains and be placed on the UPRR interchange tracks by the UPRR freight train crew. An NRL switching locomotive and crew would then bring the cars from the UPRR interchange tracks to the staging yard for inspection and administrative processing. After these processes are completed, these cars may be combined with other general freight cars present in the yard to form a train, or the cars, as a train, may be dispatched for the trip to the EOL yard.

Interchange from the NRL to UPRR would be accomplished in the reverse of the above movement descriptions.

To accomplish efficient interchange with the UPRR, pre-notification of all train/car movements to and from the UPRR, is required. This would be accomplished, in part, by drawing upon the UPRR movement control system.

The staging yard would have perimeter fencing.

### 7.2 INTERCHANGE INSPECTION OF CARS AND LOCOMOTIVES

All inbound and outbound cars received at the Caliente/Eccles staging yard would receive an inspection in accordance with FRA 49 CFR 232 and 49 CFR 215. All inspections would be performed by qualified car inspectors assigned at the staging yard. The inspection would include:

- Suspension system
- Car body
- Draft system
- Air brakes
- Two-way end-of-train devices
- Wheels

An initial terminal road train airbrake test would be conducted. The train's engineer would be notified that the test has been satisfactorily conducted. Permanent records of the inspections would be maintained at Caliente.

### 7.3 TRANSFER OPERATIONS WITH THE GROA

Loaded cask cars would be switched from the EOL yard to GROA. When ordered, an NRL crew would bring up to four cask cars at a time out of the EOL yard to the NRL/GROA operating boundary. This location would be designated by a sign and a home signal designated the GROA home signal (GHS). Operational control of a switching movement bound to the GROA would shift from the NRL to that of the GROA at this point. The GHS would be jointly controlled (interlocked) by the NRL dispatcher and GROA operator. This would facilitate coordination between the NRL and GROA control centers so that moving loaded cask cars from the EOL yard to the GROA security area would be accomplished without an enroute delay.

The GHS would normally display a red aspect, indicating stop. When ready to accept cask cars, the operator at the GROA control center would turn the GHS to a red over lunar aspect, indicating movement clearance to proceed, at restricted speed, into the cask car receipt security area. Upon receiving the red over lunar signal aspect, the loaded cask cars would be shoved (locomotive behind cask cars) to the outer gate of the Cask Car Receipt Security Station area, an enclosure that is long enough to accommodate cask car. When ready, NRL and GROA personnel would open the outer gate. Then the NRL train crew would shove the loaded cask cars into the enclosed area. Once the cask cars are inside the enclosed area, the NRL crew would secure them and uncouple the locomotive. The locomotive would then move back and the gate would then be closed and locked. At this time, GROA personnel would inspect the loaded cars, and if the cars are accepted, open the inner gate. A GROA-based locomotive would couple to the cask cars, make a test of the brakes, and pull the loaded cask cars into the repository for further handling. If a cask or cask car/s are not accepted, they would be taken back to the EOL yard or CMF for further processing.

When cask cars have been emptied, the reverse of the process described above would occur, with the empty cask cars being delivered to the NRL within the transfer/inspection area. Empty cask cars would then be removed by an NRL crew, and either delivered to the CMF for further processing or for holding in the EOL yard.

For security reasons, extra measures are taken to preclude any unauthorized movement of a cask car/s in either direction between the GROA and the EOL yard. Power operated turnouts would be located between the GHS and the GROA transfer security area. These turnouts would be interlocked with the GHS so that when the signal displays a red aspect, the switches would be in the diverging position, and when the signal displays a red over lunar aspect, the switches would be lined for a straight through movement. Figure 18 provides a schematic of the NRL/GROA interface.

The specific design elements and overall implementation of the CMF is outside the scope of NRL conceptual design. However, the ongoing conceptual design of the EOL facility has coordinated with known information regarding the CMF. The CMF may be located adjacent to the EOL yard. The general characteristics and major functions of the CMF include processing of the transportation casks, keeping them road ready and containing the correct internal equipment, including the associated transportation skids, impact limiters, lifting equipment, special tools, spare parts, and instrumentation.

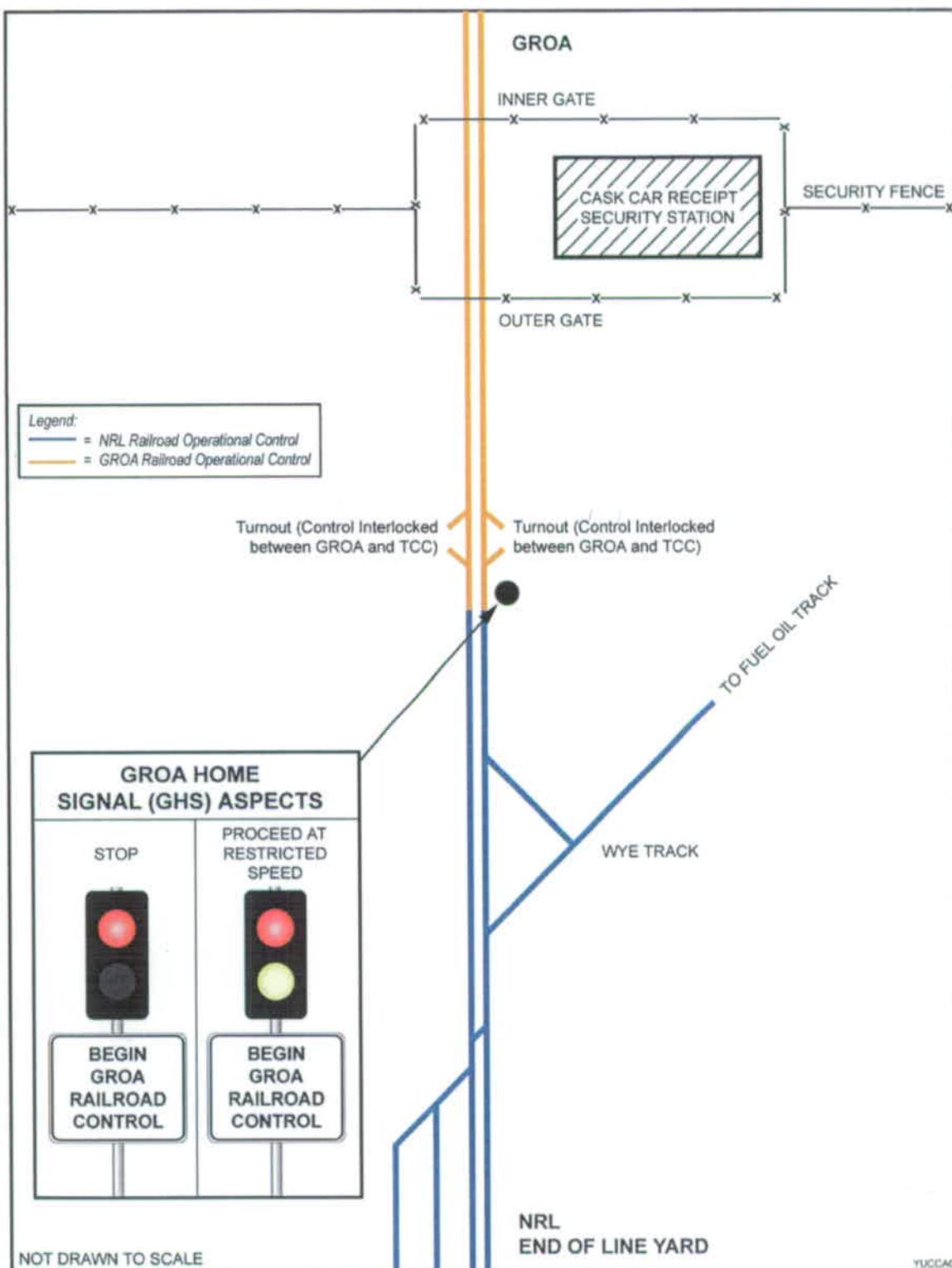


Figure 18. Schematic NRL – GROA Interface Transfer Operations

### 8.1 INTERCHANGE REPORTING AND DOCUMENTATION

NRL would receive electronic advance manifest of waybill and bill of lading data of carloads on a DOE/UPRR train well in advance of its arrival at the Caliente/Eccles area interchange. Electronic entry of this data into the NRL customer service data base would allow coded access to the status and contents of the carloads.

The NRL agent at the interchange point would conduct an inspection to verify that the advance manifest of waybill data corresponds to the actual carloads received, including car reporting marks (owner), car number, and shipper-applied seal numbers to verify that a carload's commodity has not been tampered with enroute. Any visible damage to a lading would be noted by the agent.

An electronic message would be forwarded by the NRL agency to the consignee that the specified cars are to arrive on a specified train and at the approximate hour. This message would also note any car held at the interchange for mechanical reasons and the delay, if any, that may be anticipated pending repair.

### 8.2 WASTE SHIPMENT DOCUMENTATION

All spent fuel shipments would comply with the requirements set forth by the U.S. Department of Transportation in 49 CFR 172 (identification, labeling, packaging, marking, placarding, and preparation of shipping papers) and 49 CFR 173 (general requirements for shipments and packaging of hazardous materials).

Package rules are designed to protect the public, train crew, emergency responders and package handlers by limiting radiation emissions from the package and ensuring the durability of the package. The type of package required is based upon the type, quantity, and form of the material. Type A and Type B packaging are required for materials that have higher radiation emission levels. Spent fuel casks are Type B. Packaging must meet Nuclear Regulatory Commission (NRC) requirements for integrity in case of an accident. A transport index number is placed on the package to designate the amount of care the carrier should exercise during transportation. It indicates a maximum reading of radiation exposure in millirems per hour-one meter away, or for criticality control purposes, the number obtained in accordance with 10 CFR 71.59, whichever is larger.

Each package of hazardous materials offered for transport must be marked with the proper shipping name, identification number, and the name and address of the consignor and consignee. Some materials require additional information, e.g., a radioactive package of more than 100 pounds must have its gross weight marked on the outside of the package.

Shipping papers that describe the materials and provide its proper shipping name, hazard class, identification number, and quantity of materials must accompany every shipment of hazardous materials. The shipper is responsible for giving these papers – which can be a shipping order, bill of lading, or manifest – to the carrier. In addition to the shipping manifest, the waste producer shall provide a completed "Nuclear Materials Transaction Report" completed in compliance with NRC requirements as stated in 10 CFR 74.15 Subpart B. This report is required to be completed and transferred in computer-readable format.

Nevada currently has no specific requirements for the inspection of SNF or HLW shipments. However, Nevada Administrative Code (NAC 459 – Hazardous Materials) contains requirements for low-level radioactive waste shipment.

### 9.1 UPRR INTERCHANGE

The UPRR interchange with the UPRR (UPRR interchange) is to be located along the UPRR Caliente Subdivision at either Caliente or Eccles. The UPRR interchange is a network of three tracks consisting of a lead track and two yard tracks. The facility enables the interchange of railcars containing general freight between the CRC and UPRR. General freight for the GROA (construction materials, fuel oil, site specific casks, waste packages, etc.) would arrive in UPRR freight trains and be placed on the UPRR interchange tracks by the freight train crew. A NRL switching locomotive and crew would then bring the cars from the UPRR interchange tracks to the staging yard for further processing.

The lead track enables a UPRR train to set out or pick up cars without occupying the UPRR mainline and potentially delaying other UPRR trains. Although the functions of the two remaining tracks are flexible depending on specific need at the time, generally one track would be for set out, another track for pick up, and the lead track for run-around purposes.

Loaded inbound cask trains, and other "unit" type trains would proceed directly to the staging yard passing through or bypassing the UPRR interchange tracks. At the staging yard, the UPRR locomotives would be exchanged for NRL locomotives. Figures 19 through 22 depict the site plans and track layouts and the Caliente and Eccles interchange locations. These figures are sourced from the *Facilities-Design Analysis Report, Caliente Rail Corridor* (NRP 2007b).

UPRR Interchange Functional Parameters – The functions of the UPRR interchange are

- Interchange with UPRR to CRC of loaded and empty railroad general freight rail cars
- Switching of cars
- Set out of bad order rail cars
- Allow above operations to occur clear of the UPRR main track

### 9.2 CALIENTE RAIL CORRIDOR STAGING YARD

The CRC staging yard is where railroad cars would be held and sorted into trains for delivery to the EOL facility (inbound) and UPRR interchange (outbound). Also, loaded cask trains would exchange UPRR locomotives for NRL locomotives here. Loaded cask trains would be processed intact. Interchange documentation and car/train inspection functions would be accomplished in the staging yard. Facilities at the staging yard include a locomotive fuel and sanding area, maintenance warehouse, locomotive shop area, MOW satellite office and lay down area, and a yard office with the potential for the TCC and Operations Control Center.

A total of three potential locations for the staging yard have been identified. Two for the Caliente area (Caliente Indian Cove and Caliente Upland) and one for the Eccles alternate alignment, Eccles North. Of the three, only one would be constructed. Figures 23 through 25 illustrate the three yard locations. These figures are sourced from the *Facilities-Design Analysis Report, Caliente Rail Corridor* (NRP 2007b).

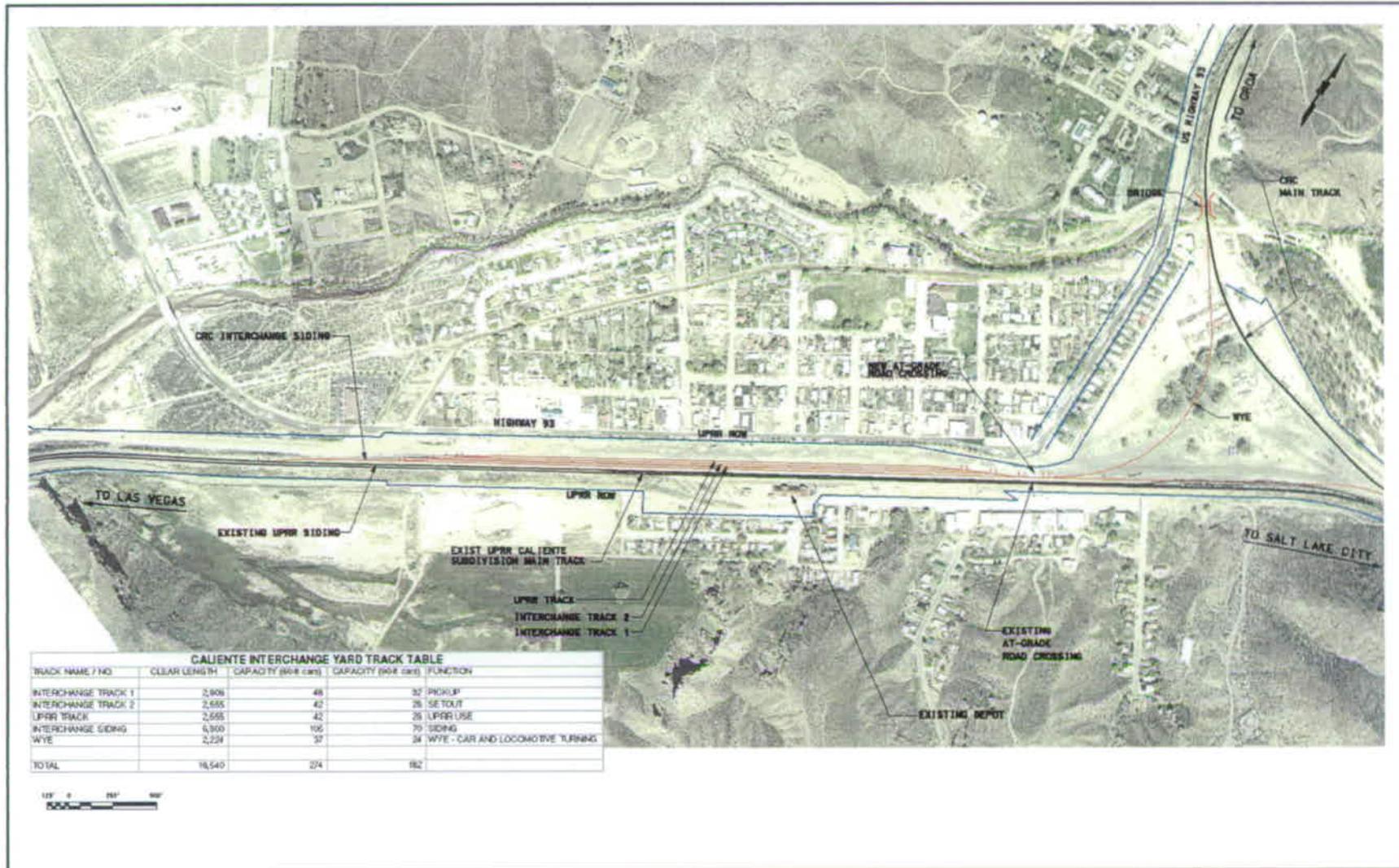
#### 9.2.1 Track Layout

The basic track configuration of the staging yard consists of 12 tracks that include a lead track, an inbound track, an out bound track, six switching tracks, a storage track, a repair-in-place (RIP) track, and a locomotive track. A 25-foot spacing between yard tracks is planned to enable an access road for car and train inspection. The staging yard is double ended permitting switching from either end.



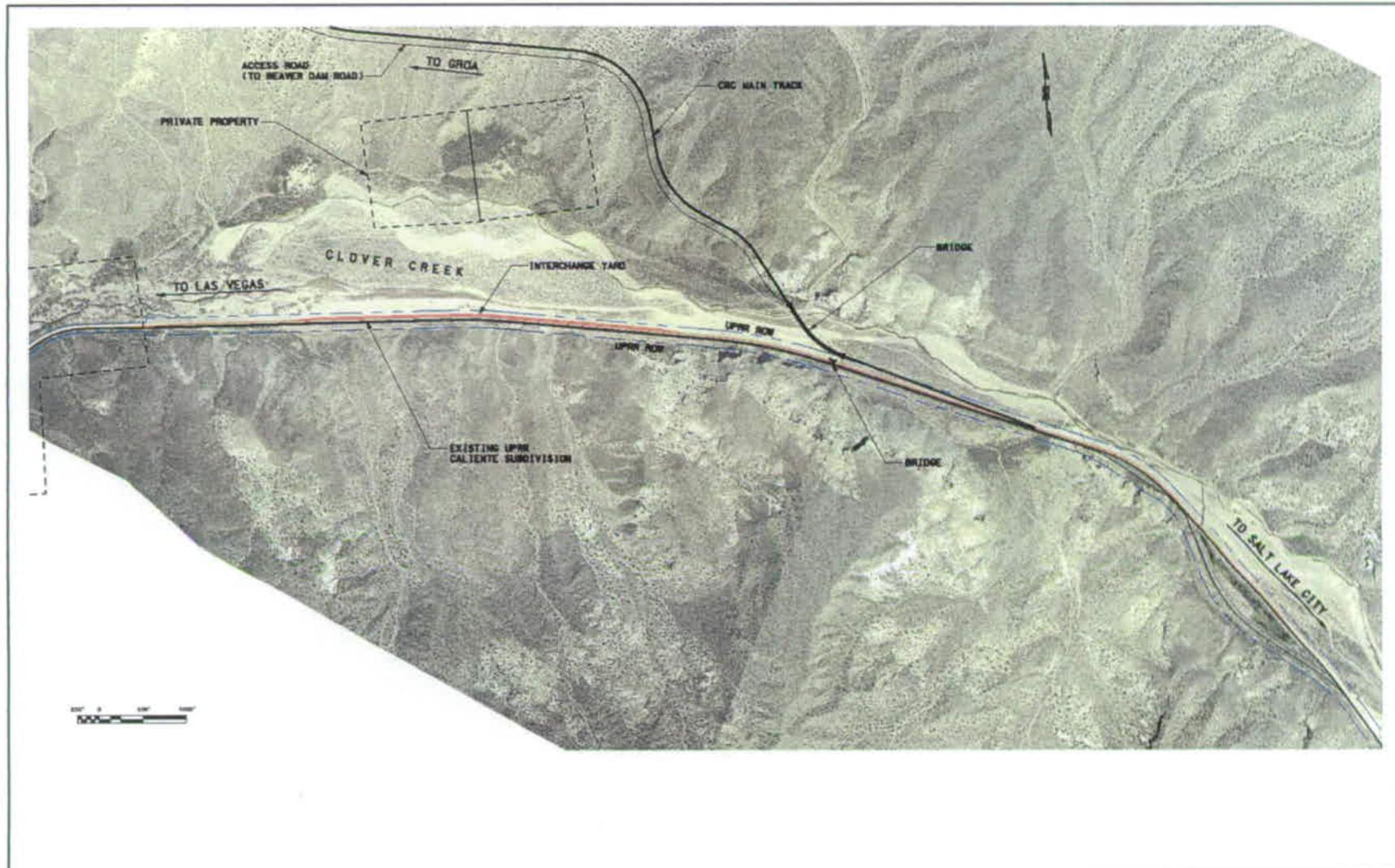
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Figure 19. UPRR Interchange – Caliente Site Plan



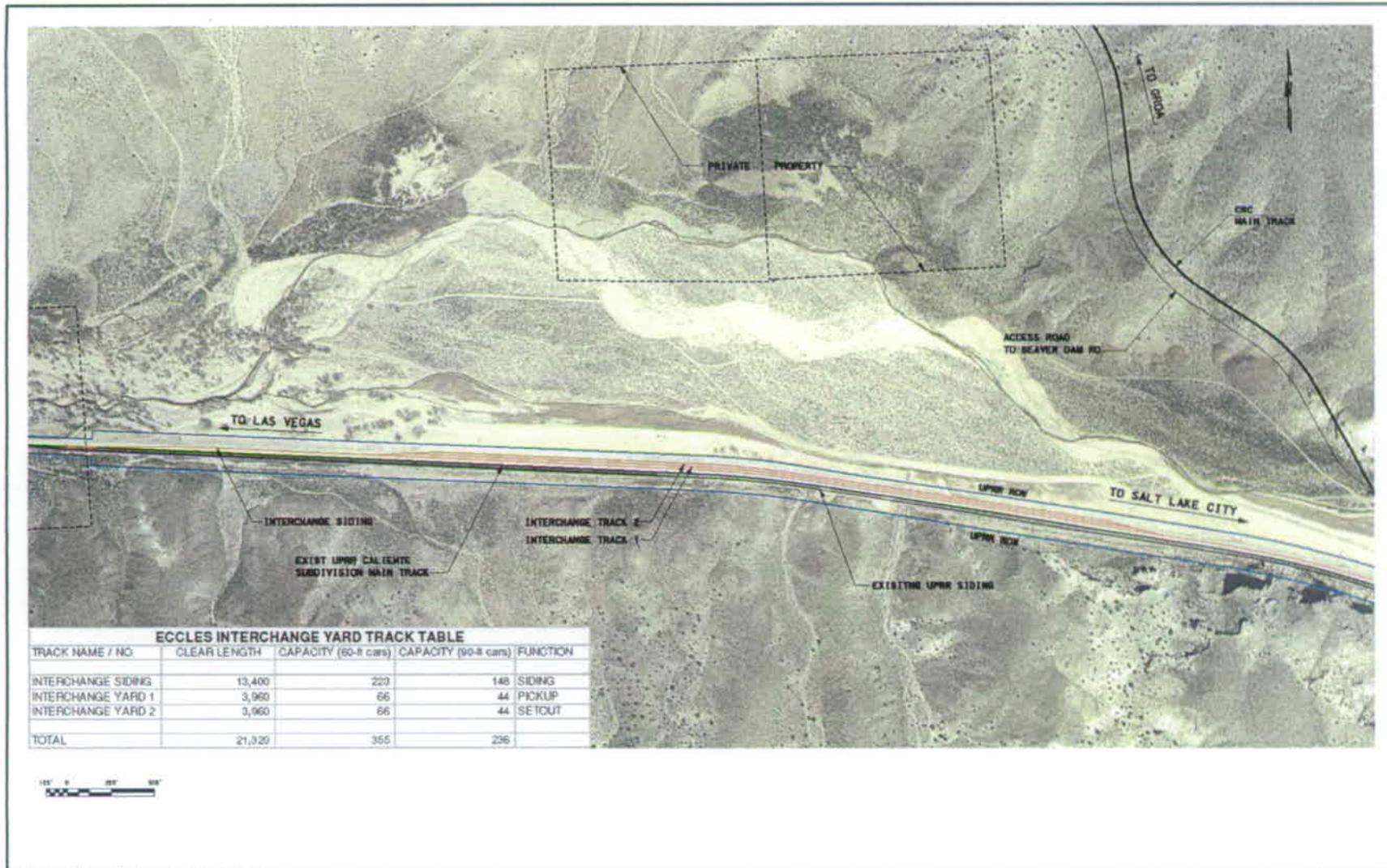
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Figure 20. UPRR Interchange – Caliente Track Layout



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Figure 21. UPRR Interchange – Eccles Site Plan



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Figure 22. UPRR Interchange – Eccles Track Layout

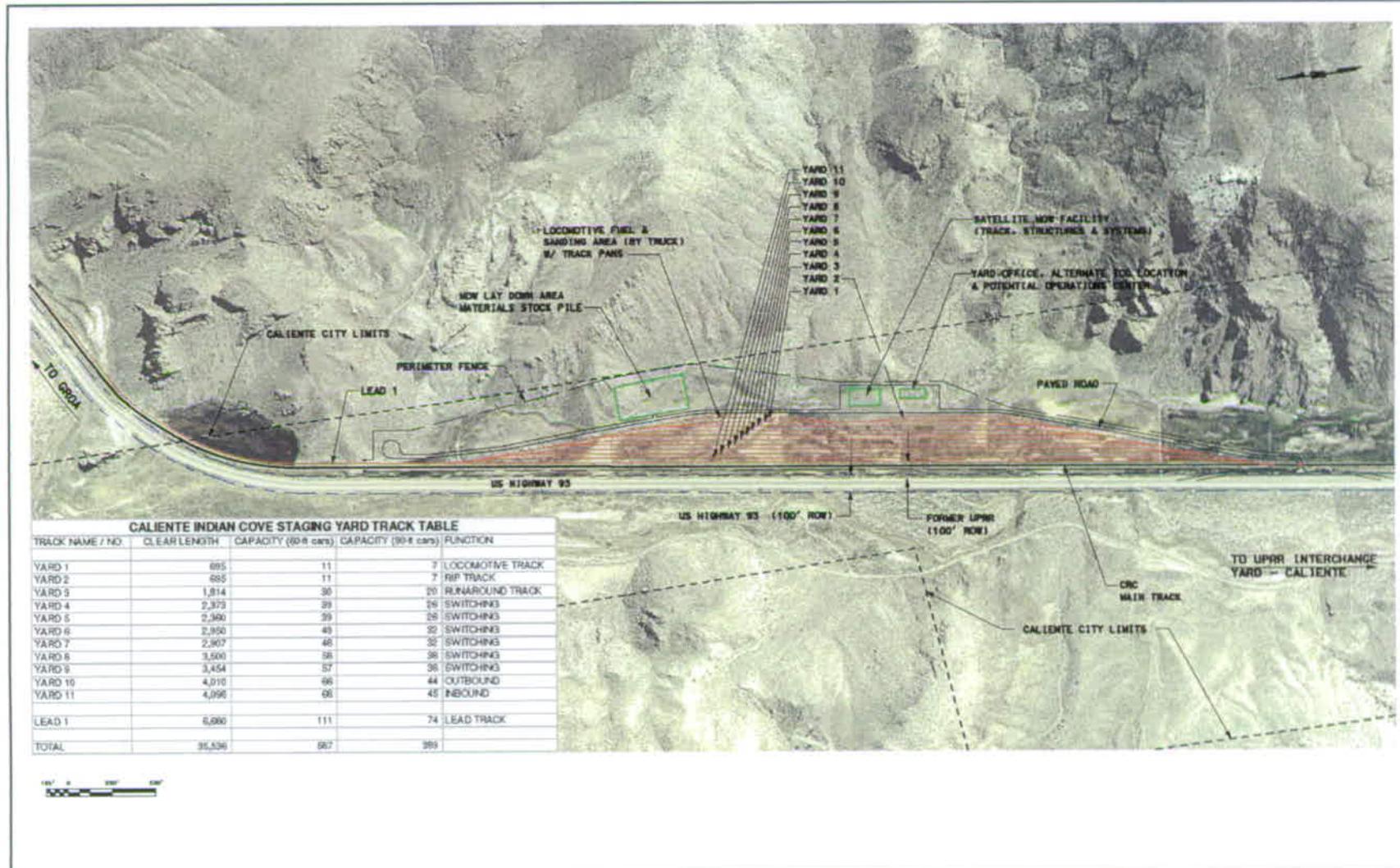
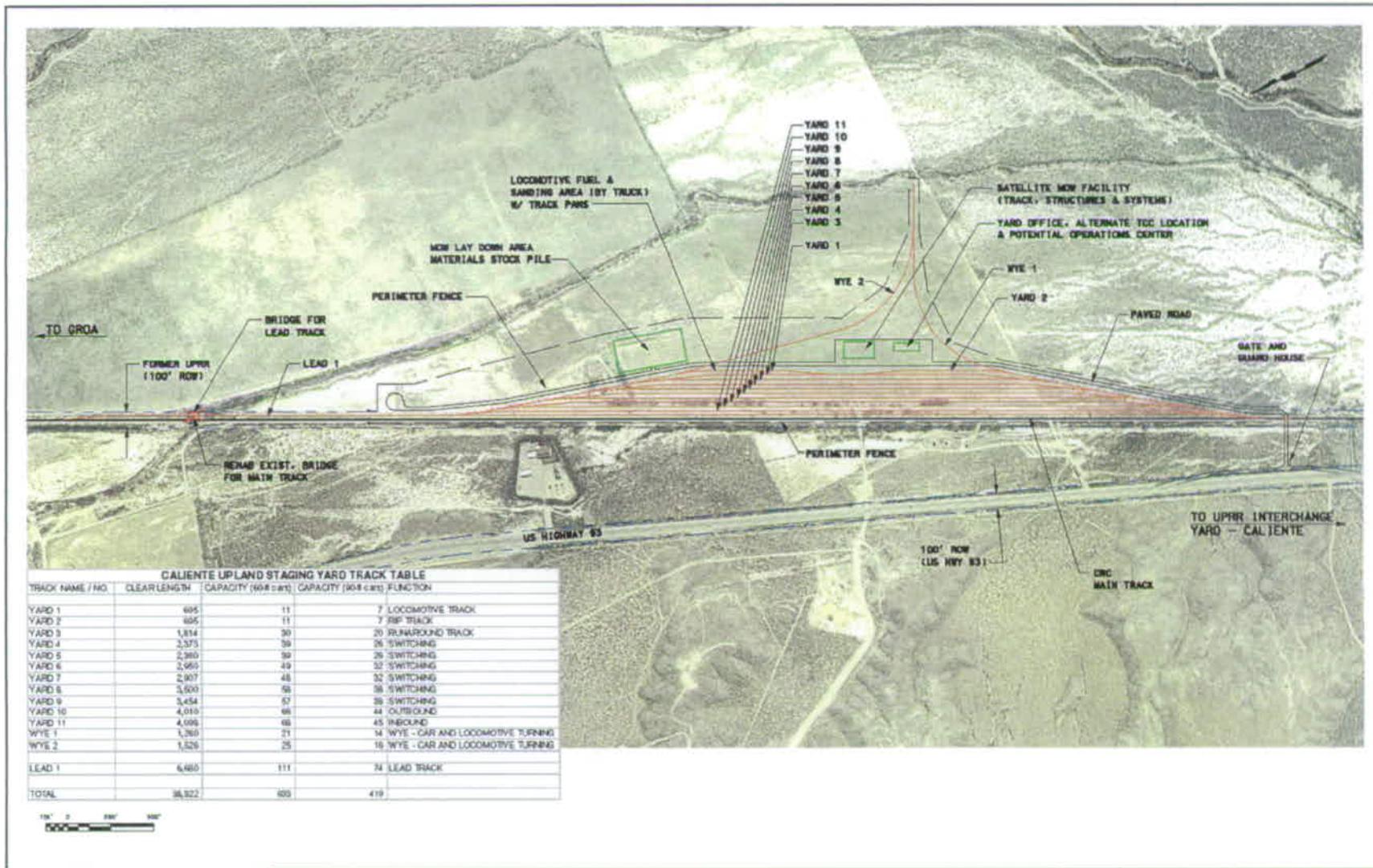
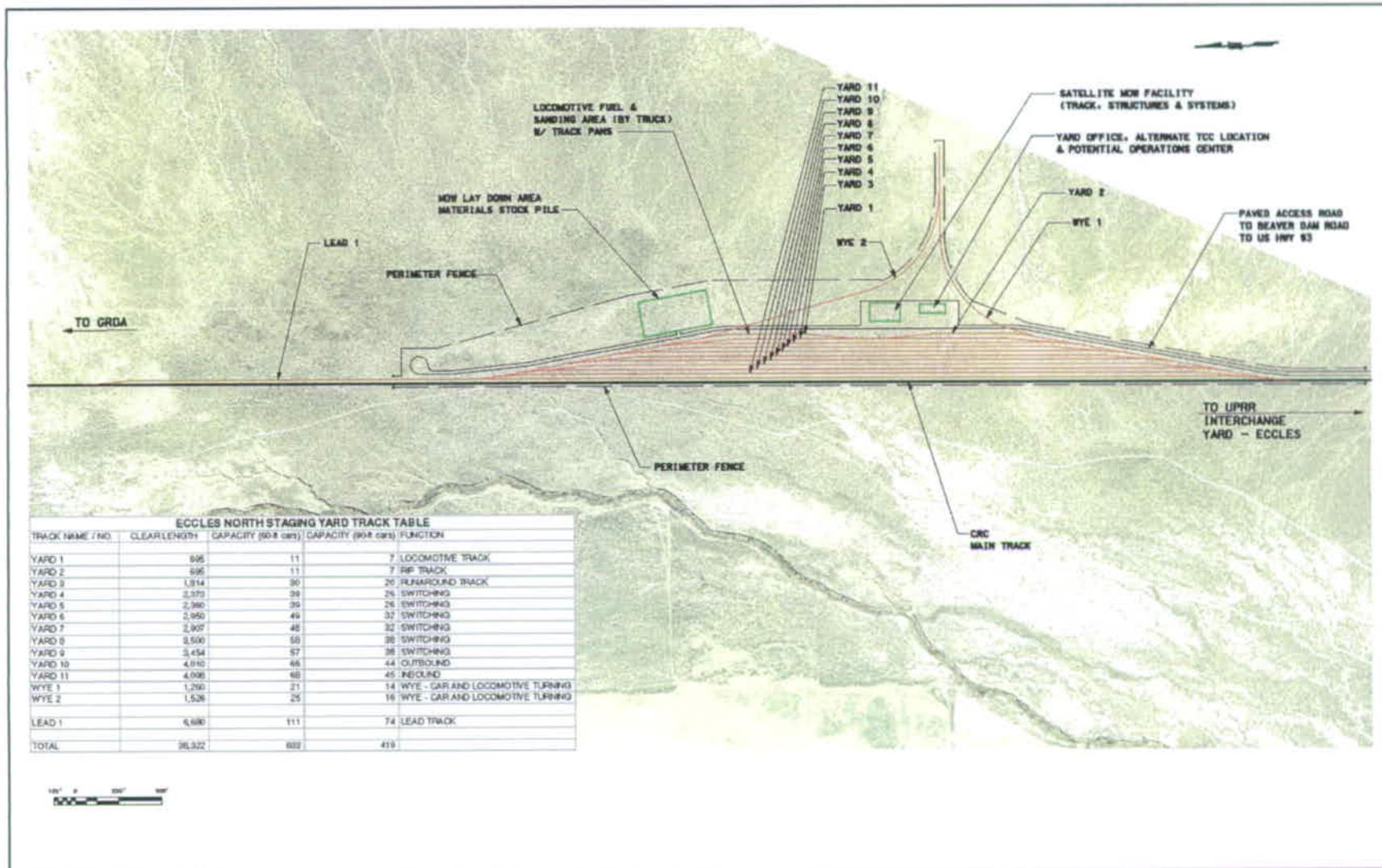


Figure 23. Staging Yard at Caliente Indian Cove



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Figure 24. Staging Yard at Caliente Upland



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Figure 25. Staging Yard at Eccles North

Although all the yard tracks have been given functional titles, the switching, inbound, and outbound tracks are functionally interchangeable. Actual use of these tracks would be decided by the yardmaster based on current conditions. The RIP track is where light running repairs (i.e. brake shoe change out, wheel change out, door repair, etc.) take place for rail cars. The locomotive track is where NRL and, if applicable, UPRR locomotives are held between road haul assignments. The assigned switching locomotives for the staging yard are also fueled and sanded on the locomotive track. Fuel oil would be supplied by a contractor operated truck. Sand and other supplies would also be furnished by truck.

During the construction of the CRC, the staging yard would be used for holding, sorting, and dispatch of cars having ballast, rail, ties, and other construction materials.

### 9.2.2 Staging Yard Functional Parameters

The functions of the staging yard interchange include:

- Interchange with UPRR to CRC of loaded/unloaded cask rail cars/other unit type trains
- Locomotive staging
- Locomotive turning and runaround capabilities
- Bad order rail car set out
- FRA safety test/inspections performed prior to train departure
- Locomotive fueling and service area
- Crew check in and crew change facility
- Parking for employee's vehicles
- Satellite MOW facility
- Facilities for the initial construction of the rail line

### 9.2.3 Yard Office

The yard office would house the yardmaster and other operations and mechanical personnel to handle the administrative functions involved with interchanging trains between CRC and UPRR. The yard office is also the potential location for the TCC and NTOC.

### 9.2.4 Satellite Maintenance-of-Way Area

A satellite MOW Area would be established at the staging yard to support the track, structures, and signal maintenance requirements at the staging yard and track facilities extending about 100 miles to the northwest. Facilities to be provided at the staging yard include a satellite MOW office, a material lay down area, and a storage area.

## 9.3 END-OF-LINE FUNCTIONS

NRL trains carrying casks loaded with SNF and HLW would travel from the staging yard to the rail line's western terminus, referred to as the EOL facilities. The EOL facilities are to be located approximately one mile south of the cask car receipt security station within the GROA. The EOL yard has three tracks on 50-foot centers to enable longer term holding of cask cars if needed. However, the operational plan is to move the cask cars to the GROA as soon as possible.

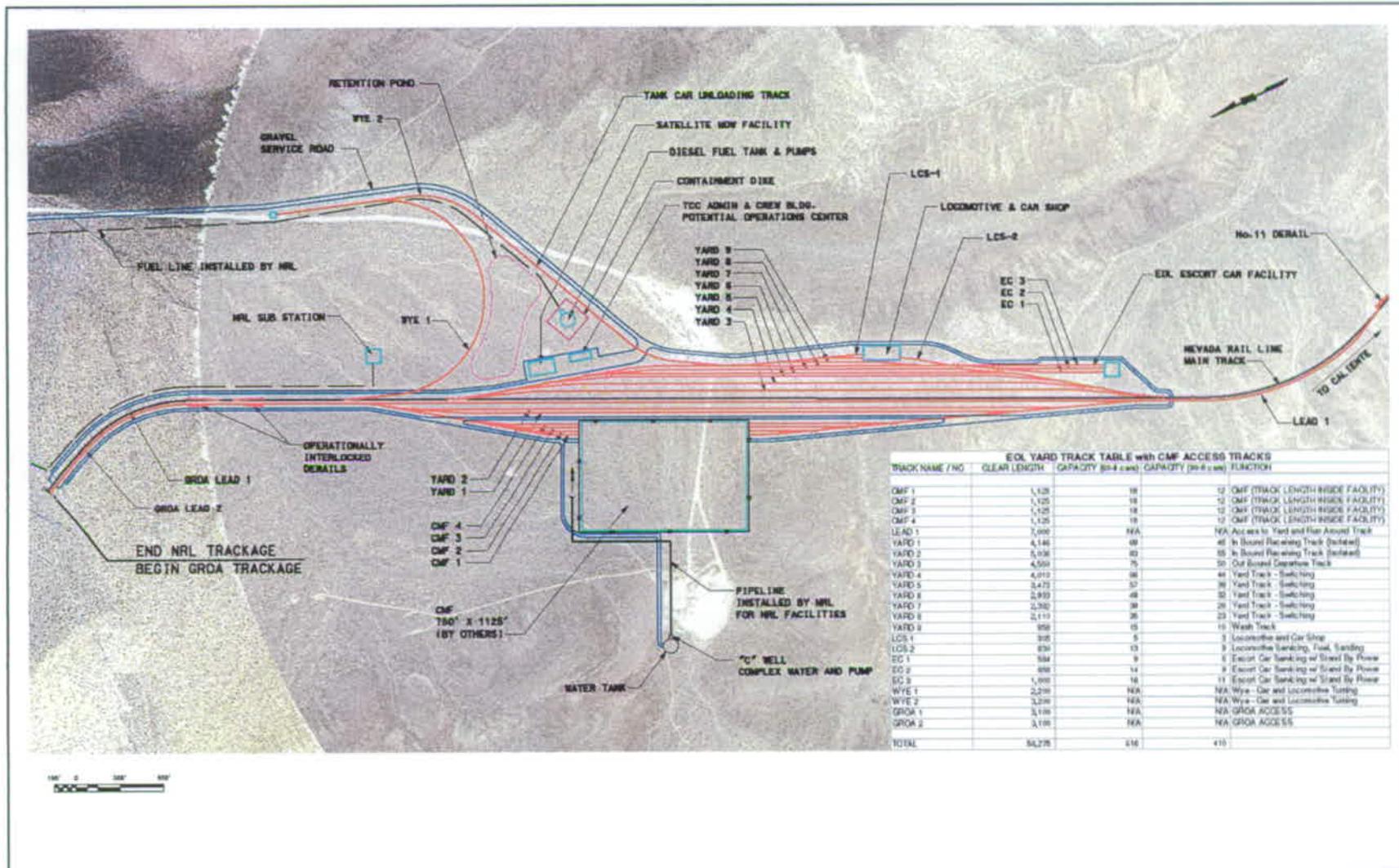
The purpose of the EOL facilities is to provide:

- A termination point for the main track movement of cask trains
- Rearrangement of train consists and for the delivery of loaded cask cars to the GROA Receipt Security Station
- Holding of buffer cars
- Receipt (from the GROA) and temporary storage of empty cask cars, casks on railcars, and of bad order railcars requiring repair
- Assembly of outgoing trains destined for the staging yard
- Receipt and delivery to the GROA of waste packages, construction materials, and fuel oil, including dedicated construction tracks
- A potential base for the TCC and NTOC
- A building to support of operations and maintenance, including the servicing, inspection, and maintenance of diesel locomotives
- A base for the support of escort cars and personnel associated with incoming (and possibly outgoing) cask train movements
- Location for locomotive light running repair facility

### 9.3.1 Track Layout

As shown on Figure 26, EOL Yard Site Plan, the tracks identified below make up the EOL yard. This figure is sourced from the *Facilities-Design Analysis Report, Caliente Rail Corridor* (NRP 2007b).

- CMF access tracks
- Run around track
- Isolated inbound receiving tracks
- Outbound departure track
- Yard switching tracks
- Escort car servicing tracks
- Locomotive and car shop
- Locomotive servicing track
- Construction material unloading tracks
- Construction material tracks
- GROA access tracks
- Wash track
- Oil spur track
- Tracks forming a wye configuration (for turning cars and locomotives)



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Figure 26. EOL Yard Site Plan

### 9.3.2 Locomotive Light Running Repair Facility

As many as ten locomotives would be available for train movements between Caliente and the GROA, for MOW functions, and for yard switching services (six road locomotives, one spare; three switching locomotives). This number excludes potential shared use commercial service.

Inbound cask trains would be hauled by two to four locomotives for adequate motive power, dynamic braking, and operational redundancy. Light running repairs, FRA required safety inspections, and NRL inspections of locomotives would be performed at the EOL facilities. AREMA defines light running repair and service for locomotives as consisting of any work involving oiling, lubricating, testing, minor adjustments, semi-annual and monthly inspections, and repairs. Such a facility would contain provisions for:

- Lubricating oil supply
- Lubricating oil drainage and disposal
- Used oil filters disposal area
- Water supply systems (raw and treated)
- Radiator water and radiator water reclaim system
- Sanitary sewer separated from industrial waste system
- Compressed air system
- Anti-slip floors in specific areas
- Fire protection
- Natural gas or propane
- Light repair shops provided with pits, elevated platforms, and light capacity cranes.
- Office area
- Locker, lunch, and toilet facilities
- Store room for tools and parts
- Welding equipment
- Hazardous material storage
- Locomotive toilet servicing
- Locomotive fueling, sanding, and washing functions

Heavy repair of locomotives would be performed on a scheduled basis and for major break downs at an off-site commercial locomotive repair facility. Locomotives would be transported by rail to the repair facilities.

### 9.3.3 Locomotive Inspections and Tests

Locomotive inspections and tests by qualified personnel, along with written reports, would be conducted in accordance with FRA rules contained in 49 CFR 229, Subpart B, as follows:

- §229.21 Daily inspection – including repairs to correct non-compliance conditions before the locomotive is returned to service.
- §229.23 Periodic inspections – conducted at facilities equipped for a complete underbody inspection, at periods not to exceed 92 days, with results recorded on prescribed FRA forms.

- §229.25 Tests at periodic inspection – includes all gauges, electrical devices and visible insulation, cable connections, and event recorders.
- §229.27 Annual tests – including cleaning, repair or replacement of air brake system.
- §229.29 Biennial tests – all valve components shall be cleaned, repaired or replaced, and tested.
- §229.31 Main reservoir tests – interval not to exceed 736 days.

### 9.3.4 Other EOL Buildings and Facilities

TCC and NTOC – The EOL is being considered as a potential site for the TCC and NTOC. The TCC is responsible to for the dispatching and monitoring of CRC train movements and coordination for the interchange operations involving the UPRR. All on track maintenance activities would also be coordinated from this office. The TCC would also be responsible for the calling of train crews who would report here or the staging yard for work assignments. The building would also support other administrative functions of the CRC.

Satellite MOW Building – This facility would support maintenance activities in conjunction with the MOW headquarters. Preliminarily, this facility would handle the maintenance needs of the EOL yard and some portion of the main track between EOL and the Tonopah area. The building would have space for offices, spare parts storage, tools and small track machinery.

Escort Car Facility – The escort car layover facility supports the servicing of escort cars. This includes cleaning of cars, restocking of supplies, and toilet servicing. This area would also be equipped with “stand by power” for supplying electricity to the escort cars to maintain air conditioning, heating, and lighting.

Tank Farm and Locomotive Fueling – A fuel tank and fuel delivery system would be provided within the EOL facility. The assumption is for a 237,000 gallon tank size for locomotive fuel, based on a one month supply reserve. Diesel fuel is to be delivered to the storage tank using rail tank cars.

### 10.1 MAINTENANCE OPERATIONAL CONCEPT

The basic approach to maintenance of the track, bridges, tunnels, culverts, highway/railway grade crossing warning devices, signals, communications, and other wayside facilities is to use track mounted vehicles to the extent possible (BSC 2005a). As a result of railroad alignment construction, most track segments would have a parallel access/fire break road. These roads may also be used for MOW purposes. Access roads are addressed in Section 4.5 of *Construction Plan, Caliente Rail Corridor* (NRP 2007a).

Maintenance would be scheduled with the TCC to minimize the impact on planned train movements. All main track maintenance would be done under work windows and clearing for the passage of trains.

Heavy track structure maintenance (tamping, surfacing, tie and rail replacement, rail grinding, rail welding, fastener inspection or replacement, etc.) requires the use of rail mounted equipment. If the maintenance activity is planned to take place over a number of days, a work materials train may be used and would be moved into the nearest passing siding to allow line traffic to pass. Slow order running may be necessary for the line traffic through the area undergoing track maintenance.

For projects that require longer durations at a remote site, highway mobile equipment would provide kitchen, overnight sleeping, and washing/toilet facilities. This equipment may either be loaded on to railroad flat cars or brought to the site on existing access roads. Power for lighting, cooling, and refrigeration, would come from self contained diesel generator equipment.

### 10.2 MAINTENANCE-OF-WAY HEADQUARTERS

Maintenance of the track, bridges, tunnels, culverts, grade crossings, signal equipment, communications equipment and other wayside facilities and equipment would be performed and coordinated from the MOW headquarters building, located approximately 5 miles south of Tonopah in Esmeralda County. In addition, the MOW headquarters staff is responsible for responding to rail related accidents, derailments, where the track conditions may have been compromised, and to help in the coordination of activities which may require recovery of locomotives, railcars, casks and other equipment that have been derailed from the track. The building would have space for the storage of spare parts, tools, and small track maintenance machines.

To minimize the cost and time to access the 331-mile track system, the desirable location for MOW headquarters is near the mid point of the Caliente to Yucca Mountain line. However, the headquarters building also needs road access and be reasonably close to a population center for personnel access. An area that fits these two criteria is a location adjacent to US 95 between Goldfield and Tonopah. Figure 27 presents a general site plan and location of the facility. This figure is sourced from the *Facilities-Design Analysis Report, Caliente Rail Corridor* (NRP 2007b).

### 10.3 MAINTENANCE-OF-WAY TRACKSIDE BUILDING AND FACILITIES

The MOW trackside facility includes a building for administrative purposes, inside storage of spare parts and small tools a shop area, and an outside storage area for heavy maintenance materials (rail, ties, ballast, etc.). The MOW trackside facility has access to the CRC mainline for the handling of rail cars carrying heavy and bulk materials, and movement of on-track maintenance machines. The MOW trackside building contains administrative, welfare, and shop/storage spaces.

This site would occupy an area of approximately six acres located in Nye County, adjacent to the CRC mainline in the vicinity of the Air Force Road 504 grade crossing (close to the boundary of the Nevada Test and Training Range).

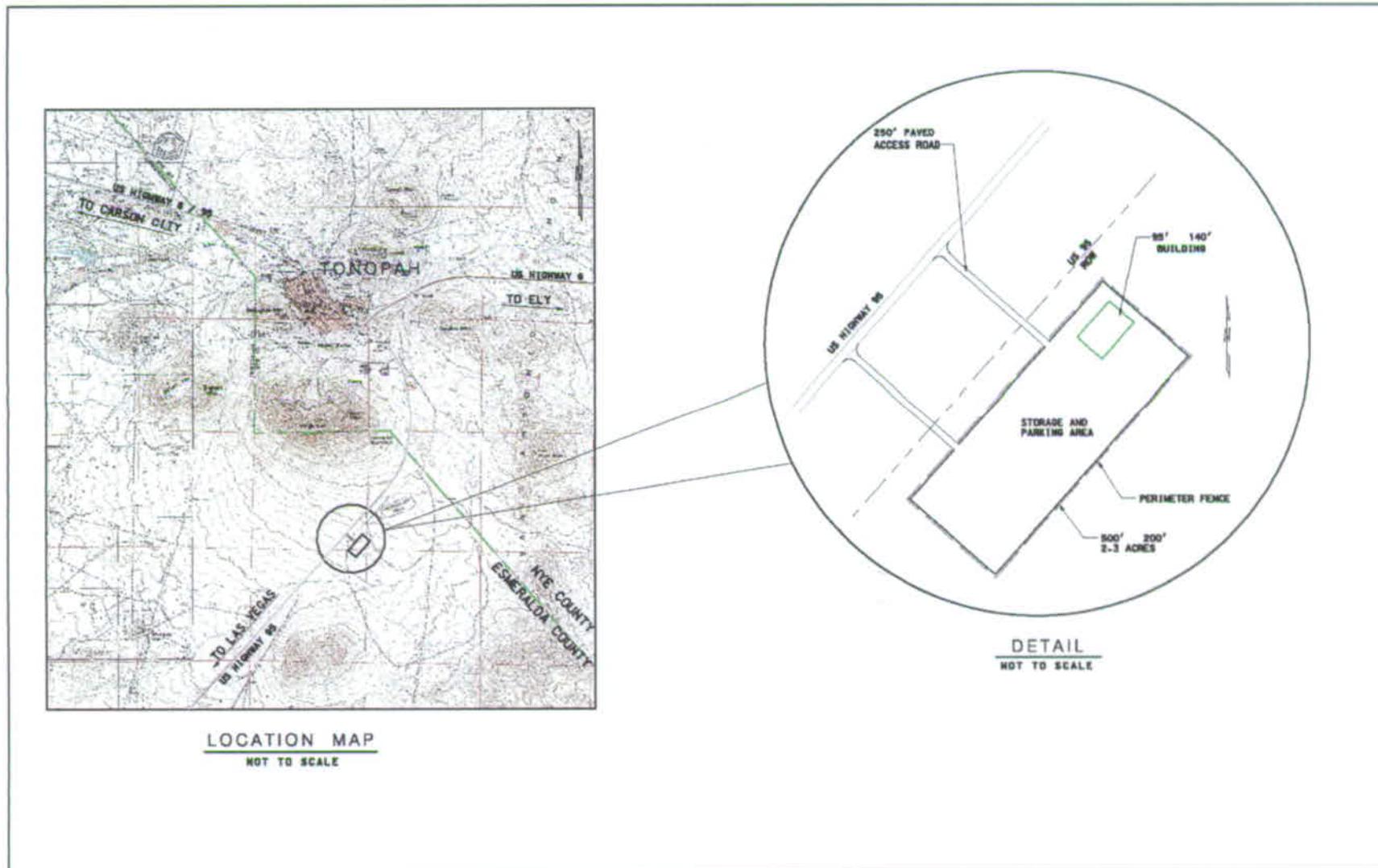
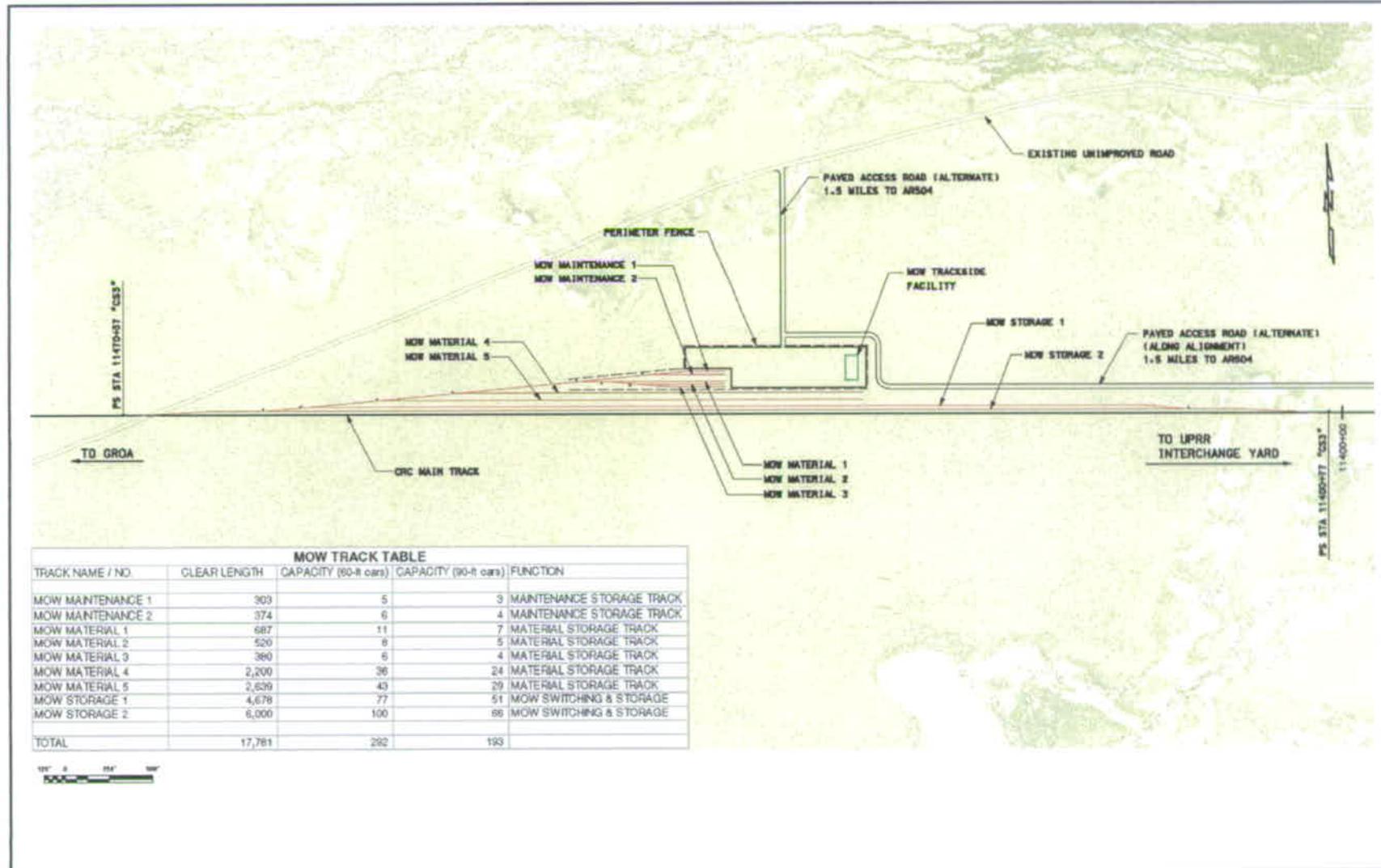


Figure 27. MOW Headquarters Site Location and Plan



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Figure 28. MOW Trackside Facility Site Plan

Refer to Figure 28 for a schematic layout of the MOW trackside facility. This figure is sourced from the *Facilities-Design Analysis Report, Caliente Rail Corridor* (NRP 2007b).

Additionally, there would be a satellite MOW facility located at the interchange yard with the UPRR and at the EOL facility. The satellite facilities would be on a smaller scale and function.

It is also intended that portions of this facility be constructed early in the project to support construction activities to build the rail line. For example, if construction plans dictate, a temporary rail welding plant, ballast loading, or other material staging facility could be located at this facility during the construction.

Functions of the MOW Trackside Facility – The purpose of the MOW trackside facility is to provide the following functions:

- Storage and maintenance of on-track rail equipment
- Hi-rail vehicle access to main track
- Temporary facilities to support construction activities
- Storage of maintenance materials
- The MOW Building Office shall provide for:
  - Lockers
  - Toilet, wash, and shower facilities
  - Private offices for 2 to 3 staff
  - General open office area
  - Training/Conference Room
- Shop area

### 10.4 TRACK MAINTENANCE

#### 10.4.1 General

Basic track maintenance would be performed to meet the requirements of 49 CFR 213. The MOW forces would be equipped to handle minor rail, tie, and turnout replacement, and routine ballasting and surfacing tasks. Minor quantities of steel, concrete, ballast, and other nationally sourced materials would be required for routine maintenance activities. According to the AAR, the length of the national rail system in 2005 was over 140,000 miles, and included 562 different railroad companies (AAR 2006). The nominal length of the CRC, approximately 331 miles, is a small part (approximately 0.24 percent) of the national rail system. Therefore, the maintenance and operations needs of the CRC would have minimal impact on the national demand for these materials.

All MOW vehicles and equipment would be equipped with radio communications. A supply of replacement track and bridge material would be placed at the MOW trackside facility, EOL facility, and the staging yard.

The following track and bridge maintenance functions would be performed by outside contractors on an as need basis:

- Ultrasonic rail testing (annual)
- Rail grinding (every third year)
- Spot brush and weed control (annual or as needed)

- Vehicle and work equipment maintenance
- Track surfacing (out of face)

### 10.4.2 Track Inspection

Track inspections, including frequency, would be conducted in accordance with the provisions of Subpart F of 49 CFR 213, Track Safety Standards. Track inspectors would be of sufficient experience to be able to conduct independent inspections of track structure for the purpose of determining compliance with the provisions of 49 CFR 213. The track inspector would possess a comprehensive knowledge of track nomenclature, inspection techniques, maintenance methods, and equipment. In addition, the inspector would have a thorough knowledge of safe operating practices while either in an on-track vehicle or on the alignment in any mode. The frequency and manner of inspecting track would be in accordance with the following FRA regulations for track inspection:

- §213.233 Track inspections, each main track is inspected twice weekly. Track inspection records would indicate which sections were inspected on foot and which sections by vehicle.
- §213.235 Inspection of switches, on foot, at least monthly.
- §213.237 Inspection of rail for internal defects, at least annually.
- §213.239 Special inspections, as soon as possible after fires, storms, tornados, earthquakes, or other such occurrences.
- §213.241 Inspection records, retained at least two years, in a non-alterable manner.

### 10.4.3 Fencing

At the present time, the NTRD (BSC 2005a) calls for new fencing, along with and parallel to the railroad, only as government agencies require. The determination of the alignment segments to be fenced would be identified as the project progresses. Refer to Appendix E for further discussion of the fencing topic.

## 10.5 SIGNALS AND COMMUNICATIONS MAINTENANCE

### 10.5.1 General

Signal maintainers would be headquartered at the MOW headquarters building, MOW trackside building and the satellite MOW facilities at EOL and the staging yard

Maintenance of signals and communication systems would be performed in accordance with FRA regulations 49 CFR 220 and 234. The inspections required vary from monthly to every 10 years, as provided in the following Inspection and Tests sections.

- §234.249 Ground tests, at least once each month.
- §234.251 Standby power, at least once each month.
- §234.253 Flashing light units, at least once each month, and lamp voltage, at least once every 12 months.
- §234.255 Gate arm and gate mechanism, at least once each month.
- §234.257 Highway-rail warning system operation, and least once each month and whenever modified.

- §234.259 Crossing warning time, at least once every 12 months and whenever the prescribed warning time is modified.
- §234.261 Highway traffic signal preemption, at least once each month.
- §234.263 Relays, at least once every 4 years, with more frequent exceptions by relay type.
- §234.267 Insulation resistance, once every 10 years.
- §234.269 Cut-out circuits, at least once every three months.
- §234.273 Results of inspections and tests, complete signed records would be retained on file until completion of the next test, with the minimum retention period of one year.

### 10.5.2 Interlocking Inspection and Tests

- §236.376 Mechanical locking in interlocking machine, at least once every two years, or when change in locking is installed.
- §236.377 Approach locking, at least once every two years.
- §236.378 Time locking, once every two years.
- §236.379 Route locking, once every two years.
- §236.380 Indication locking, once every two years.
- §236.381 Traffic locking, at least once every two years.
- §236.382 Switch obstruction test, not less than once each month.
- §236.383 Valves, valve locks, at least once every three months and valve magnets, at least once every year.
- §236.384 Crossing protection, at least once every six months.
- §236.386 Restoring feature on power switches, at least once every three months.

A supply of grade crossing, interlocking signal equipment, and communications spare parts would be kept at the signal and communication maintenance headquarters at the MOW headquarters, with a smaller supply at the MOW trackside facility, and satellite buildings at EOL and the staging yard. Any major repairs or new installations would be performed by outside contractors.

## 10.6 BRIDGE AND BUILDING MAINTENANCE

Inspection and maintenance of bridges would comply with the U.S. Department of Transportation, FRA Policy on the Safety of Railroad Bridges effective September 29, 2000, as stipulated in the Federal Register of December 30, 2000, pages 526.67-526.72.

It is anticipated that bridges would require very little maintenance for the life of this project. Bridge inspections required by federal regulations would be performed on a contract basis. Annually bridge inspections would be conducted by competent technicians capable of detecting and recording indications of structural distress. Special inspections would be conducted in response to climatic circumstances also related to track structure. Records prepared over time would be maintained as part of the bridge maintenance program, providing a valuable record of trends and rates of degradation.

Building maintenance would be performed by a crew headquartered at the MOW headquarters. Such maintenance includes repair to heating, ventilation and air conditioning systems, cleaning, and minor building repair. Any building maintenance work requiring a larger effort would be performed by outside contractors. It may be that building maintenance could be a joint effort between GROA and the CMF personnel.

### 10.7 ROLLING STOCK MAINTENANCE

NRL locomotives would be maintained on a programmed maintenance basis as specified by locomotive manufactures. Minor locomotive running repairs and required FRA and NRL locomotive inspections would be performed at the locomotive light running repair facility. AREMA defines light running repair and service of locomotives as consisting of any work involving oiling, lubricating, testing, minor adjustments, semi-annual and monthly inspections and repairs. It is anticipated the heavy repair of locomotives would be contracted to off-site shops.

NRL would not own rail freight cars used in unrestricted interchange service. NRL may own a limited number of freight cars for use in MOW trains. DOE and NRL owned freight cars would be maintained at the locomotive light running repair facility. Any other freight cars needing repairs on an emergency basis (excluding the cask cars to be maintained by the CMF) would also be handled by the locomotive light running repair facility. Maintenance of NRL and DOE owned freight cars and repairs to other freight cars is expected to be a minimal activity.

### 10.8 EMERGENCY RESPONSE

Minor incidents involving track and rail cars would be handled by NRL forces and equipment. Examples of such events include broken rail, minor washout, and one wheel set of a freight car derailed.

In the event of a derailment requiring heavy equipment (sidewinder tractors, front end loaders, bulldozers, and other support equipment) an outside contractor would be retained to carry out the rerailling operations. Each event would be handled on a case-by-case basis as to access, transportation, and rerailling procedure. The primary consideration is site accessibility.

In remote areas without roadway access, the contractor would load his heavy equipment on rail flat cars, and those cars would be moved to a rail siding (or other favorable spot) nearest to the emergency site for unloading. The equipment would be used to build an access road to the derailment site as necessary by working off-track. To the extent possible, this would be done without interference to continued rail operations. In those situations requiring prolonged work at a remote site, the contractor would bring mobile lodging and commissary facilities for the work crew.

The NRL would designate six levels of response. Levels not directly involving a SNF cask are Code-Yellow Levels 1, 2, and 3. Levels directly involving cask trains, loaded or empty, are Code-Red Levels 4, 5, and 6.

- **Yellow 1** – Disruption of track structure not affecting cask trains – broken rail and minor washout repair that would not disrupt cask movement train schedule.
- **Yellow 2** – Disruption to track structure that might involve a cask train movement – a cask train might be delayed.
- **Yellow 3** – Derailment not involving a cask train but would cause delay to a cask train movement.
- **Code-Red 4** – Derailment involving a cask train, but not involving a cask car.

- **Red 3** – Minor derailment of a cask train involving a cask car – one or more wheels of a cask car are off the rail, but the car is upright and intact.
- **Red 6** – Major derailment involving a cask train – a cask car is derailed, not upright.

### 10.9 EMERGENCY RESPONSE PROCESS

The initial channel of notification that an event has occurred requiring emergency response is to the TCC which is staffed at all times. The notification may be from NRL forces such as MOW crews, train crews, and non-NRL individuals who may witness or happen upon an event, such as a vehicle stalled on an at-grade crossing or a land slide that is undetected. NRL would have a toll-free number for the public to use for emergency notification.

The TCC dispatcher would immediately notify the senior on-call NRL operations officer and first responders such as area police and fire departments to assess the event, and based on information available, determine the necessary action. A color code would be assigned to the event. As promptly as possible, the NTOC would be advised of the event and action being taken. The event would be located as closely as possible by milepost number. Emergency responders would have been previously provided with railroad track charts and access road maps as an aid to their response.

NRL would mobilize its forces, such as MOW and train operations, for access by both off-rail (highway) and rail, to the extent necessary based upon the Color Code of the event. This response could also include summoning NRL's emergency contractors. The TCC dispatcher would update the NTOC as the response unfolds.

It should be noted that the emergency response plan described herein is concept and reflects general railroad operating practices. As the project progresses, the emergency response plan would be further developed to include integration with DOE Orders, and procedures concerning Alert, Site Area Emergencies, and General Emergency situations. This plan would also include close coordination and preparedness drills with first responders in the area.

## 11.1 ORGANIZATION

The NRL organization would be headed by a General Manager (GM), an assumption being that the railroad is part of a larger organization (an ownership company or public agency that is yet to be determined). The GM would oversee a group of functional departments necessary to the operation of the railroad. The number, nature, and size of the departments would vary according to the level of independence of the railroad. Essential core functions/departments include:

- Operations Department
- Engineering and Mechanical Department

These departments are responsible for the movement of trains and the maintenance of the railroad and its related equipment including locomotives, cars, track, structures, signaling, and communications. A typical organization is described in further detail below. Other likely functions include:

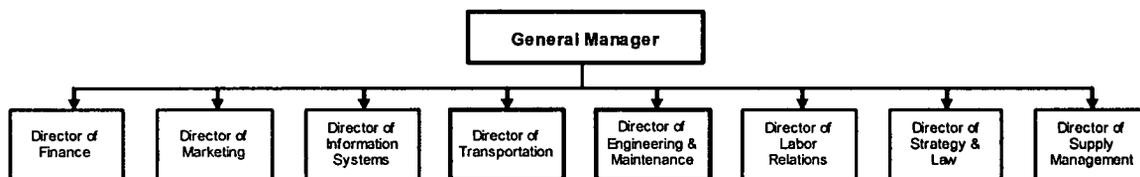
- Labor Relations
- Supply Management
- Information Systems

A more independent organization, with a commercial (shared use) freight hauling business might also include:

- Marketing
- Communications
- Finance
- Strategy and Law

It should be noted that this discussion is based on the operations as presented herein and these numbers are subject to further variation based on further project refinement.

Figure 29 presents the organization of a typical commercial railroad.



**Figure 29. Typical Commercial Railroad Organization**

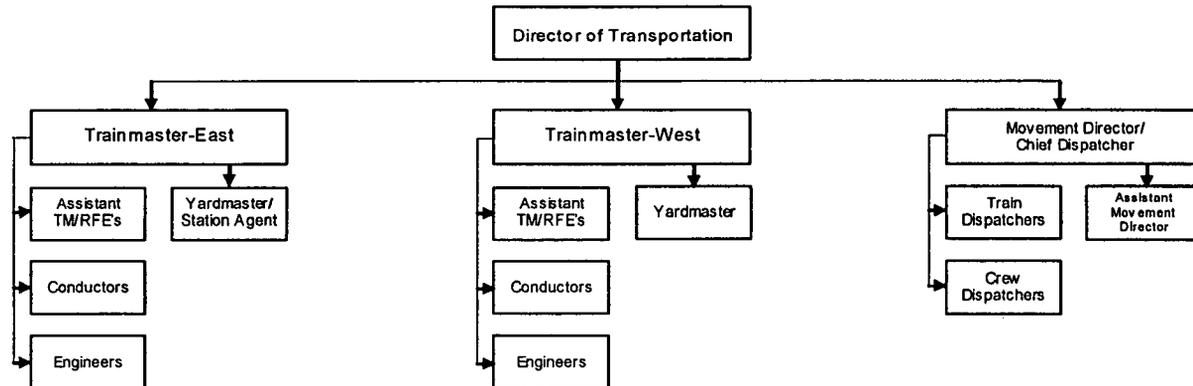
The degree to which the organization should be developed, and what departments would be included, is dependent upon the determination of the scope that the railroad management organization shall encompass. If the railroad is part of a larger operating company, some of the functions might be handled on a consolidated basis. This could also be true if the operation of the railroad was contracted to one of the regional railroad operators. Some of these organizations manage a multiplicity of unconnected smaller railroads and centralize such functions as labor relations and supply management in a central organization. This potentially could be the case for all of the possible departments outside of operations and engineering and mechanical.

The scope of the organization will be determined as the plan is further developed. Typical operation would be divided between transportation operations, and engineering and maintenance issues, with a director in charge of each. A Director of Transportation would be in charge of all personnel and activities

concerned with the movement of the trains. A Director of Engineering and Maintenance would be in charge of all personnel and activities necessary to maintain the property and equipment in good working order.

## 11.2 TRAIN OPERATIONS

Figure 30 presents the initial CRC operations organization.



**Figure 30. Initial CRC Operations Organization**

A Director of Transportation would be in charge of the functional department that manages operations. The Director would have responsibility for the movement of trains over the line and for switching movements in the yards. The department would consist of two groups:

- Movement control and dispatching
- Train crews and supervision

A Movement Director/Chief Dispatcher would be in charge of generating train movements, directing trains to move over the line, and managing crew availability. Movement control is the process of deciding what has to be moved, where it needs to go, and when how it is best to move it. This involves the larger picture of looking at what cars are to be moved and deciding what trains to originate, when to originate them, and what cars they should contain. This office also has the responsibility of establishing MOW work windows in advance so that potential disruption to through train movements would be minimized and MOW work time maximized.

Train dispatching is the practical process of prioritizing the interactions of various trains that must share the railroad. Crew dispatching involves controlling crew assignment and train employees, and filling assignments with available employees. The Movement Director would also supervise the Train Dispatchers and Crew Dispatchers.

Train Dispatchers handle the practical process of prioritizing the interactions of various trains that must share the railroad. They also manage the safe movement of MOW personnel on the rail line. They coordinate with the operations staffs at the GROA, the CMF, and the Operations Control Center. Train dispatchers, together with Crew Dispatchers, would monitor the hours of service of each train crew employee on-duty and ensure that they are relieved before their hours of service expire. Should a train crew expire before reaching their terminal, the dispatcher would arrange for a relief crew, plus transportation of the relief crew, to the train and the transportation of the expired crew to a terminal to obtain rest.

Crew Dispatchers are responsible for monitoring the availability of Conductors and Engineers while they are off duty and notifying them when they are needed to perform service. Crew Dispatchers maintain a record of all available Conductors and Engineers, including each individual's current qualifications, contact information and their immediately preceding work assignments. This database is constantly updated so that information regarding the next personnel to be called to fill assignments is always available. Depending on the scale of road and yard operations, crew dispatching might be handled by Movements Directors and Train Dispatchers.

Trainmasters (TM) would be directly in charge of train crews and yard operations, with the territory divided between east and west. They would be assisted by Assistant Trainmasters/Road Foreman of Engines (ATM) and Yardmasters. Both TMs and ATMs are qualified to operate trains, have specialized knowledge of locomotive systems, and are responsible for the supervision of train crews and their activities. Their primary responsibility is to see that trains are moved over the line efficiently and safely, in accordance with the established rules and procedures.

The Yardmasters/Station Agents (YM) have a similar supervisory responsibility regarding car movements within the yards (switching). Their function is different in that while they devise and oversee the program of car movements to be made by yard train crews, they do not assume a field position and are not qualified to operate trains. To perform their duties, YMs would have direct communication with the TCC to coordinate train and yard operations.

A YM would be assigned at the EOL yard. In addition to managing the switching activities, the YM would handle the interface with the GROA rail operation, involving the handoff of cask cars and waste disposal cars.

A YM/Station Agent would be assigned at Caliente. In addition to managing the switching activities there, the YM/agent would handle the required record keeping and reporting. The YM/agent would be responsible for billing, ordering and furnishing of cars; reporting overages, shortages, damage to cars and lading, and the filing of interchange reports.

Train crews actually move the trains over the line, or shift cars in the yards, under the direction of TMs and YMs. A crew consists of an Engineer and a Conductor. The Engineer operates the locomotives to move cars in yards, or pull trains over the line. The Conductor operates switches and couples and uncouples cars, and handles necessary record keeping pursuant to a yard shift's activities, or a train movement.

In the yards, the train crew performs switching to move cars among the tracks to assemble or disassemble trains, and to access particular cars for placement or delivery. Should remote control be adopted, the locomotive engineer's position could be eliminated on some yard crews. In commercial service, train crews place cars for loading and unloading at the facilities of shippers and consignees.

Positions for the traditional clerks have not been suggested because it is assumed that record keeping would be through electronic means, and that database access would be available to all personnel, including Conductors and Engineers. They would be equipped with laptops and able to access information on car location and train makeup, and update it directly.

### 11.3 TRAIN CREW MANAGEMENT

In developing a typical pattern of train crew activity, some basic assumptions were made.

- Road crews would consist of a Conductor and an Engineer.
- Road crews would rotate on a first in-first out basis.

- All road crews would be based at Caliente.

The rotation of crews is developed to accommodate the randomly generated pattern of train movements for the period 2015 through 2019, which includes two cask trains, two other DOE-related trains, and five to six shared-use (commercial) trains per week. A flat 12 hours was assumed on each run, which corresponds to the crew rotation depicted in Figure 31. This includes prep time and running time. In this example, it was assumed that crews handling commercial trains operate to the EOL, although this is unlikely to be the case.

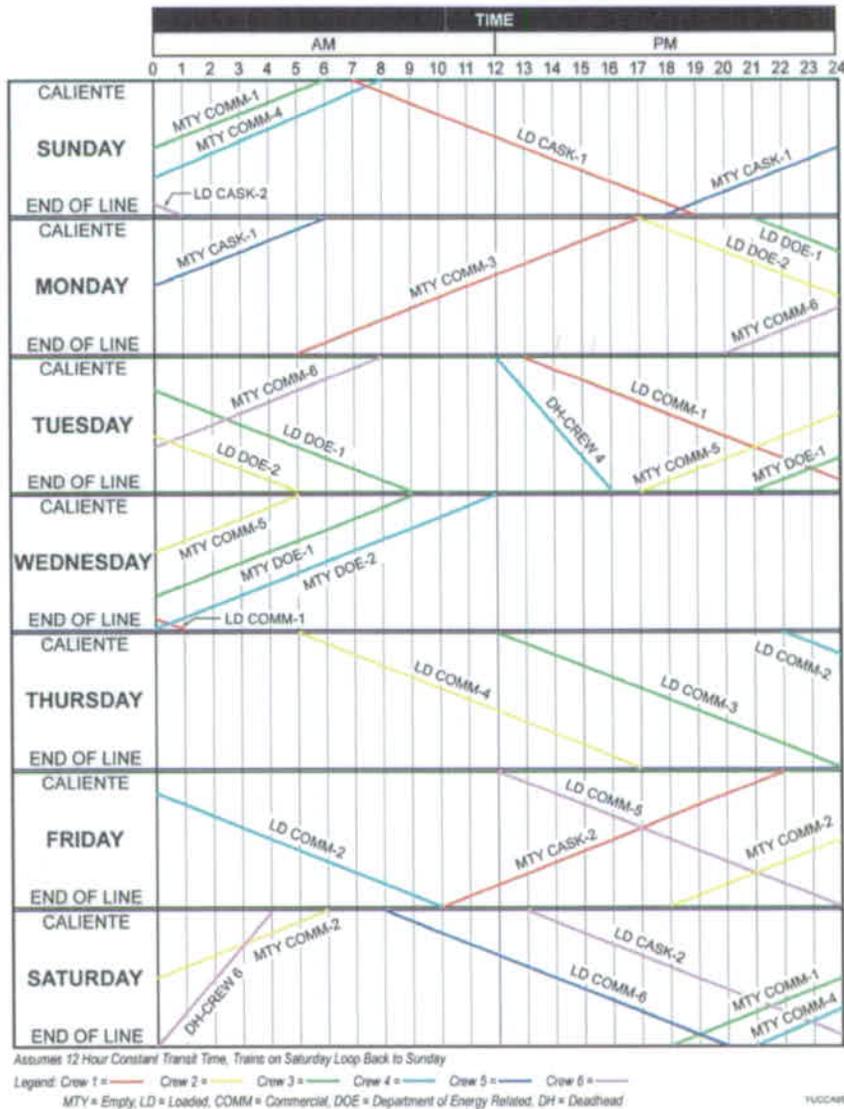


Figure 31. Typical Train Crew Rotation

An examination of the rotation indicates several factors to be faced in providing crews to move trains. The situation presented here is challenging in its unbalanced distribution of train movements. Nonetheless, it is one that is realistic and needs to be addressed.

The characteristics in this particular random distribution are a lack of westbound movements combined with the presence of three eastbound trains on Wednesday, and a multiplicity of movements on Saturday and Sunday. It is important to note that these concentrations and gaps occur with no regular pattern, and

not necessarily on any particular day. Although the scenario addresses only one week, it does reflect the type of operations that the NRL can expect throughout the year.

The imbalance of train movements throughout the week causes a crew to be needed for only one trip, and one to deadhead west to return east with a train. Another crew works west, immediately deadheads east, and returns to work west after only nine hours off. Additionally some crews incur excessive layovers at the EOL of as much as 57 hours. There are six layovers that exceed 24 hours and one of 23 hours. Breaking these up with deadheads should be considered. It costs money to house these people, and it is unreasonable, in terms of their personal lives, to hold them away from their homes for long periods of time. There also is the cost of lodging to be considered, possibly either for an NRL-provided facility, including the costs to staff and maintain it, or the costs for motel rooms and meals. Typically, "away-from-home" pay could be awarded to these crews should it become necessary to hold them at their "away-from-home" locations.

There also may be additional labor costs in housing crews at the outlying terminal. Although there are no labor agreements in effect, it is standard practice in the industry to pay crews for time at the layover point, typically whatever part of the last eight hours of each 24-hour period is incurred. The crew with the 57-hour layover would make two full days pay and cause the operator to incur the cost of their lodging as well, yet they would be totally unproductive during that period.

The alternative is to deadhead them when there appears to be little chance of working them back, and deadhead a crew out for a return trip, when necessary. At some point, the cost to house a crew can exceed the cost of deadheading. In further analysis, this issue should be addressed.

### 11.4 TRAIN CREW STAFFING REQUIREMENTS

The number of Engineers and Conductors required is based on a combination of the number of road crews required and the number of yard crew assignments. It is assumed that a crew would consist of one Engineer and one Conductor. In addition, a number of "extra" (substitute) personnel must be kept available to fill vacancies and unscheduled assignments.

Six crews are required to handle the hypothetical week's worth of road train movements discussed above. This assumes that the extended layovers at the away-from-home-terminal are acceptable. This may not be the case and at least one other crew may then be required.

A total of nine yard crews are required to cover all yard assignments, plus an extra crew working one day at each location. This assumes that a yard crew would be on duty on each shift, seven days per week, at both Caliente and the EOL. In addition, a second crew would work five days each week at the EOL.

#### Extra Crews

Basic to the nature of railroad operations is a need to assign personnel on short notice to cover vacancies, both planned and unexpected. Vacancies can arise due to sickness, vacation, unpaid leave, extra trains required for unexpected traffic, and work trains. Unexpected delays can disrupt crew rotation and require that other employees be called to fill in. To properly manage this, unassigned operating employees are kept ready to be called when needed on short notice. They are referred to as "Extra" employees. An "Extra List" is maintained, consisting of qualified employees available for duty, on short notice. Extra employees work in rotation. When one goes off duty at the end of an assignment, he is placed at the bottom of the list. As vacant assignments come close to their start time, the first employees available are called and instructed where to report, and for what.

#### Relief Crews

In order to provide a viable service that satisfies the needs of the service, it will be necessary to operate the full schedule every day, seven days a week. Crews must be assigned to fill all of the scheduled trips. It is assumed that employees will work five days each week. Therefore, days off will have to be covered by other crews. These assignments could be filled by extra employees, or they could be covered by "Relief Crews". Relief crews work a different assignment on each of five days, covering the off days of five regular crews.

### 11.5 DISPATCHER STAFFING REQUIREMENTS

The discussion assumes that Train and Crew Dispatcher positions need to be filled on a three-shift/seven-day basis, with minor exceptions. The odd shifts left over after the relief assignments would not be filled. No extra positions are maintained, and regularly assigned employees would be asked to fill irregular vacancies on their days off. Therefore, in the same manner as yard crews, there are relief assignments for Train Dispatchers and Crew Dispatchers, in addition to the regular assignments.

Another possibility for consideration is the cross training of Engineers, Conductors, and Dispatchers, and a combined extra list to cover all positions.

### 11.6 MAINTENANCE-OF-WAY FACILITIES AND ROLLING STOCK

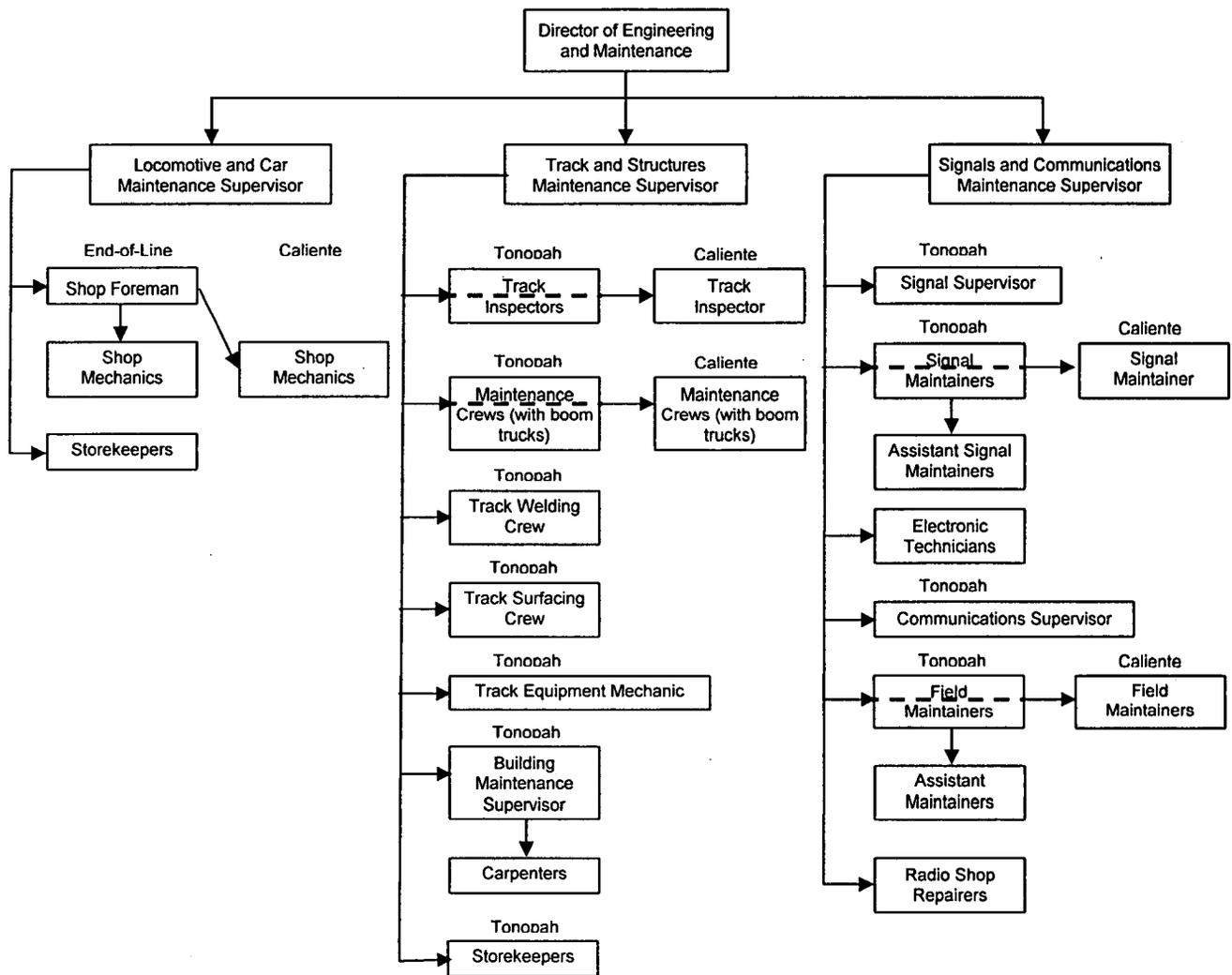
Facility maintenance includes the process of maintaining the track and ROW to required standards. It also includes maintaining the necessary structures. Other areas of maintenance include communications (telephone and radio) and signaling. Signaling includes the specialized traffic signals that govern the movements of trains, the associated interlockings that control the power operated switches at sidings, highway/railroad at-grade crossing warning devices, maintenance of the asset protection devices (such as slide fences) and responding to emergencies 24/7.

It is expected that major work would be contracted for, and this discussion includes only the basic requirements for daily inspection, responding to emergencies, and light repair. The function would likely be based at Tonopah, with some activity based at Caliente. A discussion of the presumed activities follows. Figure 32 presents an initial CRC organization chart of the maintenance function.

### 11.7 TRACK AND STRUCTURES MAINTENANCE

It is assumed that:

- Hi-rail set-off pads would be located, as a minimum, at each interlocking. Each pad would have a 32 - foot - long concrete crossing surface. These are used to permit maintenance trucks equipped to ride on the rails to mount and dismount.
- (Annual) Bridge inspections would be performed by an outside consultant.
- Building and structures maintenance would be performed by outside contractors to large extent. A very small force would be retained to perform minor repairs.
- An 800-foot-long stub track would be located off of each siding for the storage of MOW equipment.



**Figure 32. Initial CRC Maintenance Organization**

Personnel would include a Maintenance Supervisor at Tonopah, in charge of

- Track Inspectors
  - Headquartered at Tonopah
  - Headquartered at Caliente
- Maintenance crews with hi-rail boom trucks
  - Headquartered at Tonopah
  - Headquartered at Caliente

These crews would perform all routine track and structures maintenance of mainline including the yard tracks at Caliente and at the Repository/EOL.

- Track welding crews headquartered at Tonopah, each consisting of at least
  - A track welder and helper

- A backhoe with operator headquartered at Tonopah
- Spot-surfacing crews headquartered at Tonopah, each consisting of at least
  - A tamper operator
  - A regulator/broom operator
  - A truck driver with hi-rail crew cab truck with lube and fuel equipment

This crew would perform spot surfacing over entire line, including the Caliente and EOL yard tracks.

- Maintenance equipment mechanics headquartered at Tonopah
- Building maintenance crew headquartered at Tonopah
  - Building maintenance Supervisor
  - Carpenters
- Storekeepers headquartered at Tonopah

### 11.8 SIGNALS AND COMMUNICATIONS MAINTENANCE

The personnel required to maintain the signals and communications facilities are based on the following assumptions:

- Interlockings at both ends of each siding
- Wayside signals and/or signal control cases located about every three miles
- Asset protection devices located as needed
- Hi-rail set off pads
- Communications – VHF, Microwave and Satellite
- Microwave or radio control at each end of siding

The signals maintenance staff would consist of one Signal Supervisor at Tonopah supervising:

- Signal Maintainers headquartered at Caliente and at Tonopah
- Assistant Signal Technicians at Tonopah (as needed to cover vacations, holidays, etc.)
- Electronic Technicians at Tonopah

The communications maintenance staff would consist of

- Communications Supervisor at Tonopah
  - Field Communications Maintainers headquartered at Caliente and at Tonopah
- Assistant Communications Maintainer at Tonopah
- Radio Shop Repairman at Tonopah to service vehicle radios, wayside equipment and locomotive radios

### 11.9 ROLLING STOCK MAINTENANCE

Locomotive maintenance scheduling criteria can be established in three different ways; calendar-based mileage-based or MW/hr (power produced). FRA mandates safety inspections by calendar, so several safety inspections must be calendar-based, but mileage or total power produced could be used for scheduling routine maintenance, such as oil and filter changes, which should be scheduled in conjunction with the safety inspections. An industry trend is developing that instead of scheduling a locomotive

overhaul, a major component change-out philosophy is being adopted to minimize the amount of locomotive downtime. Modern locomotives have on-board computer diagnostics as a tool to track and predict required locomotive service intervals.

The particular maintenance strategy to be used by NRL is dependent upon the recommendations of the locomotive manufacture.

The envisioned staffing level for the maintenance of locomotives and cars would include:

- Director of Engineering Maintenance
- Locomotive/Car Maintenance Supervisor
- Storekeepers

## 11.10 INITIAL CALIENTE RAIL CORRIDOR STAFFING REQUIREMENTS

The initial staffing requirements for the core functions of operations and engineering and maintenance are difficult to determine at this time. As noted in the beginning of this section, the need for some departments depends of the relationship with a larger organization that has not yet been defined. Therefore, staffing for operations and maintenance has been estimated based upon the anticipated amount of work that will need to be done regardless of where the positions are located in an organizational structure. Staffing requirements at each facility are summarized in Table 7. The satellite MOW shop at the EOL facility will be intermittently staffed by personnel headquartered at either Tonopah MOW facility. In addition, approximately 15 TCC/NTOC employees are included in the EOL staffing total.

**Table 7. Staffing Matrix Summary**

Staff Position	Primary Location				Total
	Staging Yard	MOW Headquarters	EOL Facility	MOW Trackside Facility	
Professional	4	4	11	1	20
Labor	46	2	25	37	110
Clerical	0	4	4	2	10
<b>Total</b>	<b>50</b>	<b>10</b>	<b>40</b>	<b>40</b>	<b>140</b>

## 12.0 Operating and Maintenance Costs

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### 12.1 BASIS OF DEVELOPMENT FOR THE CALIENTE RAIL CORRIDOR OPERATING AND MAINTENANCE COST ESTIMATE

#### 12.1.1 Objective

The primary objective of this section is to document the methodologies and the practices that have been established for cost estimating efforts, as well as to describe the content and organization of this cost estimating documentation. These methodologies and practices are based on progressive development of this report, continuing refinement of the NRL conceptual design and operating goals, and response to comment of previous cost estimating efforts.

#### 12.1.2 Organization of Estimate

Two spread sheets are presented herein. The first spread sheet presents the estimated CRC operations and maintenance costs for DOE-related traffic and the mid-level commercial traffic presented in the *Rail Transportation Economic Impact Evaluation & Planning* prepared for Nye County, Department of Natural Resources and Federal Facilities (WSA 2005). This spread sheet is referred to as the CRC Operating and Maintenance Costs, DOE and Commercial Traffic and is presented in Table 8 at the end of this section. The second spread sheet presents the estimated costs for only the DOE traffic, and is referred to as CRC Operating and Maintenance Costs, DOE Only, and is presented in Table 9 at the end of this section.

The spread sheets are divided into three headings: Operations, MOW, and Mechanical. Appropriate line items are quantified under each heading. Costs are presented annually for the 50-year life of the project.

#### 12.1.3 Basis of Estimate

The cost presented herein are considered order of magnitude and based on the traffic data as cited above. Further, numerous operating assumptions were made to develop the cost estimates presented herein. These assumptions may change as the project advances and, consequently, could affect the estimated costs.

The costs presented in the spread sheets reflect 2005 dollars and are constant through the presentation. No attempt has been made to escalate the cost figures over the fifty year operating period. A 35 percent contingency is added to the total costs, resulting in a grand total. Further, no costs have been quantified for the administrative functions of a commercial type operation such as marketing, sales, finance, law, information systems, insurance, depreciation, etc.

Staffing costs are based on the levels itemized in Table 7, Staffing Matrix Summary, presented in the previous section. Annual staffing levels are estimated by adjusting the staffing levels in Table 7 to match trains handled for the particular year. All wage data include fringe benefits.

It should be noted that some costs are relatively fixed regardless of the volume of trains handled. For example, signals and communications costs are principally fixed because the system remains constantly operating and must be inspected and tested, regardless of the number of trains handled. Upper management costs are also relatively fixed as the General Manager position is not dependent on train volume, and trainmasters are assigned a geographic area to supervise operations. Other costs are stair stepped in nature. For example, a given number of mechanics is able to maintain one to five locomotives; yet to maintain six locomotives, additional mechanics would be required. However, the resultant crew would be able to maintain six to ten locomotives. Some data in the spread sheets reflect these cost trends.

## 12.0 Operating and Maintenance Costs

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The cost totals generally follow the volume trend of train movements. Between Years 1 and 3 there is a general ramp up of train movements and costs. Between Years 4 and 17, there is a fairly stable rate of traffic. Beginning in Year 18, traffic begins a slight reduction to Year 25. By Year 26, the vast majority of DOE traffic is completed and total traffic levels take a significant dip. The lower traffic levels remain steady for the balance of the project's life to Year 50.

The following paragraphs describe the individual line items quantified in the spread sheets.

### Operations

Administrative – This item includes wages for the General Manager, Director of Operations, Trainmasters, Yardmasters, Dispatchers, and other personnel directly involved with the direction or supervision of train movements.

Train Crew – This item includes the wages for the train crew. A train crew of two persons is assumed, an Engineer and Conductor. Number of crews required varies and is dependent on volume of train and switching movements each year.

Materials/Contracts – This item includes the costs for materials and support contracts required by the Operating Department. Costs include an allowance for maintaining the escort car fleet (20 cars).

Support materials include the operating and maintenance costs of auto, hi-rail, and other vehicles supporting operations; and supplies, such as office supplies, computer support, and gasoline for all NRL vehicles. An allowance has been included to cover the cost of utilities for the facilities located in Tonopah and Caliente/Eccles.

It is envisioned the contracts would be negotiated to cover the following items:

- Intermediate and major level building repairs
- Building cleaning
- Maintenance and repair of paved highways serving CRC facilities
- Snow removal
- Auto and truck maintenance
- Computer support
- Vegetation control
- Fencing repair

### Maintenance-of-Way

Track – This item includes wages for supervisory and labor personnel including maintenance supervisor, track inspectors/maintainers, welders, machine operators (tamper, ballast regulator) and other miscellaneous personnel. Minor adjustments to staffing levels are made to reflect changing traffic patterns.

Signals – This item includes signals and communications supervisory and labor personnel including supervisor, signal maintainers, communications supervisor, electronic technician, field maintainer, etc. It should be noted that in the DOE-only case, the signal system is deactivated from Year 26 to Year 50. This is because the NRL handles only the fuel oil train and a very occasional other DOE-related train. The communications system would remain operative during this period for train dispatching and other uses.

## 12.0 Operating and Maintenance Costs

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Bridge and Building – This item includes supervisory and labor personnel including supervisors, carpenters, storekeepers, etc.

Materials – This item is an allowance for consumable supplies and replacement parts for the Track, Signals and Communication and, Bridge and Building departments.

Contract Work – This is an allowance for contract work that is beyond the capabilities of the in-house maintenance staff. Contracts include services for annual bridge inspections and rail flaw detection. An amount of \$500,000 is budgeted for a surfacing program the third year (to correct post construction spot settlement) and every five years through Year 25. An amount of \$500,000 is budgeted for rail grinding in the 15th year. This grinding program covers the heavy grade areas (1.75 -2.0 percent) should track corrugation begin to develop. Considering the low overall gross tons projected for the NRL, it is unlikely that rail grinding would be necessary on other segments of the track route.

### **Mechanical**

Administrative/Labor – This item includes supervisory and labor personnel including locomotive maintenance supervisor, shop mechanics, escort car maintenance personnel, storekeeper, etc.

Materials – This item is an allowance for locomotive repair and maintenance parts, such as traction motors, spare truck components, air filters, electrical equipment, oil, lubricants, etc.

Locomotive Maintenance – FRA safety inspections and other routine maintenance (change air filters, oil, lubricants, etc.) are assumed to be accomplished by NRL forces. An allowance of \$50,000 per locomotive is programmed for brake overhaul every five years. Locomotive trucks are programmed for overhaul every ten years at \$100,000 per locomotive. The locomotives would reach the 1,000,000 mile mark in about 15-16 years. At that interval, a \$200,000 engine overhaul is programmed.

For the DOE and Commercial Traffic option, 11 locomotives are assumed for the Years 1 through 21. These 11 locomotives consist of eight road locomotives and three switchers. Between Years 21 and 25, a road locomotive is deleted because of decreasing traffic. At Year 25, a significant traffic decrease takes place and the locomotive fleet decreases to five road locomotives and three switchers.

For the DOE-only case, nine locomotives are assumed between Years 1 and 21; six road units and three switchers. Between Years 22 and 25, a road locomotive is deleted because of decreasing traffic. At Year 25, a significant traffic decrease takes place and the locomotive fleet decreases to two road locomotives. The road locomotives can accomplish any switching that may be needed.

# 12.0 Operating and Maintenance Costs

**Table 8. CRC Operating and Maintenance Costs, DOE and Commercial Traffic**

		Years 1 through 16																
Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Operating & Maintenance Costs	<b>Operations</b>																	
	Administrative/Security	1,328,000	2,055,000	2,340,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000
	Train Crew	1,400,000	1,800,000	2,400,000	2,800,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
	Fuel	2,744,000	3,457,000	3,984,000	4,073,000	4,128,000	4,142,000	4,123,000	4,123,000	4,133,000	4,152,000	4,115,000	3,838,000	3,874,000	3,883,000	3,888,000	3,888,000	3,890,000
	Materials/Contracts	700,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
	<b>Sub Total</b>	<b>6,172,000</b>	<b>8,112,000</b>	<b>9,704,000</b>	<b>10,468,000</b>	<b>10,723,000</b>	<b>10,737,000</b>	<b>10,718,000</b>	<b>10,718,000</b>	<b>10,728,000</b>	<b>11,247,000</b>	<b>11,210,000</b>	<b>10,933,000</b>	<b>10,960,000</b>	<b>10,976,000</b>	<b>10,991,000</b>	<b>10,991,000</b>	<b>10,993,000</b>
	<b>Maintenance-of-Way</b>																	
	Track	1,415,000	1,415,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000
	Signals	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000
	Bridge and Building	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000
	Materials	200,000	300,000	400,000	400,000	400,000	400,000	600,000	800,000	1,000,000	1,200,000	1,400,000	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000
	Contract Work	350,000	350,000	850,000	350,000	850,000	350,000	400,000	600,000	800,000	1,600,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	2,100,000	1,100,000
	<b>Sub Total</b>	<b>3,713,000</b>	<b>3,813,000</b>	<b>4,938,000</b>	<b>4,438,000</b>	<b>4,938,000</b>	<b>4,438,000</b>	<b>4,688,000</b>	<b>5,088,000</b>	<b>5,488,000</b>	<b>6,488,000</b>	<b>6,188,000</b>	<b>6,388,000</b>	<b>6,388,000</b>	<b>6,388,000</b>	<b>6,388,000</b>	<b>7,388,000</b>	<b>6,388,000</b>
	<b>Mechanical</b>																	
	Administrative/Labor	1,698,000	1,698,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000
	Materials	600,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000
Locomotive Heavy Maintenance					550,000					1,850,000								
<b>Sub Total</b>	<b>2,298,000</b>	<b>3,398,000</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>4,098,000</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>5,198,000</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>5,048,000</b>	<b>4,798,000</b>	
<b>Total</b>	<b>12,183,000</b>	<b>15,323,000</b>	<b>18,190,000</b>	<b>18,454,000</b>	<b>19,769,000</b>	<b>18,723,000</b>	<b>18,864,000</b>	<b>19,354,000</b>	<b>19,764,000</b>	<b>22,933,000</b>	<b>20,946,000</b>	<b>20,869,000</b>	<b>20,905,000</b>	<b>20,914,000</b>	<b>21,427,000</b>	<b>21,427,000</b>	<b>21,171,000</b>	
<b>Contingency = 35%</b>	<b>4,264,650</b>	<b>5,363,050</b>	<b>6,366,550</b>	<b>6,466,900</b>	<b>6,916,650</b>	<b>6,663,050</b>	<b>6,633,900</b>	<b>6,773,900</b>	<b>6,917,400</b>	<b>8,026,550</b>	<b>7,331,100</b>	<b>7,304,150</b>	<b>7,316,780</b>	<b>7,316,780</b>	<b>7,316,780</b>	<b>8,189,450</b>	<b>7,789,850</b>	
<b>Grand Total</b>	<b>16,447,650</b>	<b>20,686,050</b>	<b>24,556,550</b>	<b>24,921,900</b>	<b>26,674,650</b>	<b>25,276,050</b>	<b>25,587,900</b>	<b>26,127,900</b>	<b>26,681,400</b>	<b>30,959,550</b>	<b>28,277,100</b>	<b>28,173,150</b>	<b>28,221,780</b>	<b>28,233,000</b>	<b>31,826,450</b>	<b>29,230,850</b>	<b>28,930,850</b>	
Train Traffic	<b>DOE-related</b>																	
	Train trips (in and return)	232	340	358	406	430	438	428	428	432	440	424	374	390	394	400	384	
	Tons	420,793	527,131	558,036	642,544	711,837	746,307	723,577	726,735	724,501	754,503	733,444	458,920	482,523	485,514	486,709	491,359	
	Trains per week	4	7	7	8	8	8	8	8	8	8	8	7	8	8	8	7	
	<b>Commercial (Shared-Use)</b>																	
	Train Trips (in and return)	312	418	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520
	Tons	1,230,793	1,484,843	1,660,594	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500
	Trains per week	6	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	<b>Total DOE and Commercial</b>																	
	Total Train trips (in and return)	544	758	878	926	950	958	948	948	952	960	944	894	910	914	920	904	
Tons	1,651,586	2,011,974	2,218,630	2,520,044	2,589,137	2,623,807	2,601,077	2,604,235	2,602,001	2,632,003	2,610,944	2,336,420	2,360,023	2,363,014	2,364,209	2,368,859	2,368,859	
Total trains per week	10	15	17	18	18	18	18	18	18	18	18	17	18	18	18	18	17	

# 12.0 Operating and Maintenance Costs

**Table 8. CRC Operating and Maintenance Costs, DOE and Commercial Traffic**

		Years 17 through 35																			
Year		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
Operating & Maintenance Costs	<b>Operations</b>																				
	Administrative/Security	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	2,595,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	
	Train Crew	3,000,000	2,400,000	240,000	2,400,000	2,400,000	2,200,000	2,200,000	2,200,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	
	Fuel	3,906,000	3,797,000	3,643,000	3,643,000	3,631,000	3,607,000	3,603,000	3,490,000	3,178,000	3,133,000	3,128,000	3,128,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	
	Materials/Contracts	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	
	<b>Sub Total</b>	<b>11,001,000</b>	<b>10,292,000</b>	<b>7,978,000</b>	<b>10,138,000</b>	<b>10,126,000</b>	<b>9,902,000</b>	<b>9,898,000</b>	<b>9,785,000</b>	<b>8,073,000</b>	<b>5,971,000</b>	<b>5,966,000</b>	<b>5,966,000</b>	<b>5,616,000</b>							
	<b>Maintenance-of-Way</b>																				
	Track	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,940,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	
	Signals	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	
	Bridge and Building	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	
	Materials	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	
	Contract Work	1,100,000	1,100,000	1,100,000	1,700,000	1,100,000	1,100,000	1,100,000	1,100,000	1,600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	1,100,000	
	<b>Sub Total</b>	<b>6,388,000</b>	<b>6,388,000</b>	<b>6,388,000</b>	<b>6,988,000</b>	<b>6,388,000</b>	<b>6,388,000</b>	<b>6,388,000</b>	<b>6,388,000</b>	<b>6,388,000</b>	<b>6,798,000</b>	<b>4,521,000</b>	<b>5,021,000</b>								
	<b>Mechanical</b>																				
	Administrative/Labor	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	1,848,000	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	
	Materials	1,700,000	1,700,000	1,700,000	1,700,000	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	
	Locomotive Heavy Maintenance				1,500,000	3,200,000					400,000										
	<b>Sub Total</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>3,548,000</b>	<b>5,048,000</b>	<b>6,648,000</b>	<b>3,448,000</b>	<b>3,448,000</b>	<b>3,448,000</b>	<b>3,448,000</b>	<b>3,848,000</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>2,847,500</b>	<b>1,847,500</b>	<b>1,847,500</b>	<b>1,847,500</b>	<b>2,047,500</b>	
	<b>Total</b>	<b>20,937,000</b>	<b>20,228,000</b>	<b>17,914,000</b>	<b>22,174,000</b>	<b>23,162,000</b>	<b>19,736,000</b>	<b>19,734,000</b>	<b>19,621,000</b>	<b>18,719,000</b>	<b>12,139,500</b>	<b>12,134,500</b>	<b>12,134,500</b>	<b>11,784,500</b>	<b>12,984,500</b>	<b>11,784,500</b>	<b>11,784,500</b>	<b>11,784,500</b>	<b>12,284,500</b>	<b>12,784,500</b>	
	<b>Contingency = 35%</b>	<b>7,327,950</b>	<b>7,079,800</b>	<b>6,269,900</b>	<b>7,760,900</b>	<b>8,106,700</b>	<b>6,908,300</b>	<b>6,906,900</b>	<b>6,867,350</b>	<b>6,551,650</b>	<b>4,248,825</b>	<b>4,247,075</b>	<b>4,247,075</b>	<b>4,124,575</b>	<b>4,544,575</b>	<b>4,124,575</b>	<b>4,124,575</b>	<b>4,124,575</b>	<b>4,299,575</b>	<b>4,474,575</b>	
<b>Grand Total</b>	<b>28,264,950</b>	<b>27,307,800</b>	<b>24,183,900</b>	<b>29,934,900</b>	<b>31,268,700</b>	<b>26,644,300</b>	<b>26,640,900</b>	<b>26,488,350</b>	<b>25,270,650</b>	<b>16,388,325</b>	<b>16,381,575</b>	<b>16,381,575</b>	<b>15,909,075</b>	<b>17,529,075</b>	<b>15,909,075</b>	<b>15,909,075</b>	<b>15,909,075</b>	<b>16,584,075</b>	<b>17,259,075</b>		
Train Traffic	<b>DOE-related</b>																				
	Train trips (in and return)	404	356	288	288	241	272	272	222	84	64	62	62	52	52	52	52	52	52		
	Tons	499,946	459,841	372,885	374,372	362,908	355,364	348,965	264,447	66,467	35,116	33,910	33,910	29,145	29,145	29,145	29,145	29,145	29,145		
	Trains per week	8	7	6	6	5	5	5	4	2	1	1	1	1	1	1	1	1	1		
	<b>Commercial (Shared-Use)</b>																				
	Train Trips (in and return)	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	
	Tons	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	
	Trains per week	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
	<b>Total DOE and Commercial</b>																				
	Total Train trips (in and return)	924	876	808	808	781	792	792	742	604	584	582	582	572	572	572	572	572	572	572	
Tons	2,377,446	2,337,341	2,250,385	2,251,872	2,240,408	2,232,864	2,226,465	2,141,847	1,943,967	1,912,616	1,911,410	1,911,410	1,806,645	1,906,645	1,806,645	1,806,645	1,806,645	1,806,645	1,806,645		
Total trains per week	18	17	16	16	15	15	15	14	12	11	11	11	11	11	11	11	11	11	11		

## 12.0 Operating and Maintenance Costs

**Table 8. CRC Operating and Maintenance Costs, DOE and Commercial Traffic**

		Years 36 through 50																
Year		36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	Total	
Operating & Maintenance Costs	<b>Operations</b>																	
	Administrative/Security	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	1,538,000	101,283,000
	Train Crew	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	82,040,000
	Fuel	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	2,778,000	165,538,000
	Materials/Contracts	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	45,200,000
	<b>Sub Total</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>5,616,000</b>	<b>394,041,000</b>
	<b>Maintenance-of-Way</b>																	
	Track	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	1,463,000	84,025,000
	Signals	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	68,910,000
	Bridge and Building	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	16,190,000
	Materials	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	47,800,000
	Contract Work	600,000	600,000	600,000	600,000	1,200,000	600,000	600,000	600,000	1,100,000	600,000	600,000	600,000	600,000	400,000	200,000	100,000	47,800,000
	<b>Sub Total</b>	<b>4,521,000</b>	<b>4,521,000</b>	<b>4,521,000</b>	<b>4,521,000</b>	<b>5,121,000</b>	<b>4,521,000</b>	<b>4,521,000</b>	<b>4,521,000</b>	<b>5,021,000</b>	<b>4,521,000</b>	<b>4,521,000</b>	<b>4,521,000</b>	<b>4,521,000</b>	<b>4,121,000</b>	<b>3,921,000</b>	<b>3,821,000</b>	<b>259,185,000</b>
	<b>Mechanical</b>																	
	Administrative/Labor	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	847,500	87,087,500
	Materials	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	60,100,000
	Locomotive Heavy Maintenance					1,200,000						400,000						13,250,000
	<b>Sub Total</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>2,847,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>2,047,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>1,647,500</b>	<b>847,500</b>	<b>140,437,500</b>
	<b>Total</b>	<b>11,784,500</b>	<b>11,784,500</b>	<b>11,784,500</b>	<b>11,784,500</b>	<b>13,584,500</b>	<b>11,784,500</b>	<b>11,784,500</b>	<b>12,284,500</b>	<b>11,784,500</b>	<b>12,184,500</b>	<b>11,784,500</b>	<b>11,784,500</b>	<b>11,384,500</b>	<b>11,184,500</b>	<b>10,284,500</b>	<b>10,284,500</b>	<b>793,663,500</b>
<b>Contingency = 35%</b>	<b>4,124,575</b>	<b>4,124,575</b>	<b>4,124,575</b>	<b>4,124,575</b>	<b>4,754,575</b>	<b>4,124,575</b>	<b>4,124,575</b>	<b>4,299,575</b>	<b>4,124,575</b>	<b>4,264,575</b>	<b>4,124,575</b>	<b>4,124,575</b>	<b>3,984,575</b>	<b>3,914,575</b>	<b>3,599,575</b>	<b>3,599,575</b>	<b>277,782,225</b>	
<b>Grand Total</b>	<b>15,909,075</b>	<b>15,909,075</b>	<b>15,909,075</b>	<b>15,909,075</b>	<b>18,339,075</b>	<b>15,909,075</b>	<b>15,909,075</b>	<b>16,584,075</b>	<b>15,909,075</b>	<b>16,449,075</b>	<b>15,909,075</b>	<b>15,909,075</b>	<b>15,369,075</b>	<b>15,099,075</b>	<b>13,884,075</b>	<b>13,884,075</b>	<b>1,071,445,725</b>	
Train Traffic	<b>DOE-related</b>																	
	Train trips (in and return)	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	10,055	
	Tons	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	13,521,554	
	Trains per week	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	<b>Commercial (Shared-Use)</b>																	
	Train Trips (in and return)	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	25,688
	Tons	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	1,877,500	92,618,730
	Trains per week	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	<b>Total DOE and Commercial</b>																	
	Total Train trips (in and return)	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	572	35,743
Tons	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	1,906,645	106,140,284	
Total trains per week	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	

# 12.0 Operating and Maintenance Costs

**Table 9. CRC Operating and Maintenance Costs, DOE Only**

	Year	Years 1 through 16															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<b>Operating &amp; Maintenance Costs</b>																	
<b>Operations</b>																	
Administrative/ Security	1,328,000	1,373,000	1,373,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000	1,863,000
Train Crew	800,000	1,400,000	1,400,000	1,400,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Fuel	1,347,000	1,582,000	1,832,800	1,740,000	1,796,000	1,812,000	1,793,000	1,802,000	1,802,000	1,802,000	1,784,000	1,507,000	1,543,000	1,552,000	1,565,000	1,530,000	1,530,000
Materials/contracts	500,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
<b>Sub Total</b>	<b>3,975,000</b>	<b>5,165,000</b>	<b>5,205,800</b>	<b>5,803,000</b>	<b>6,459,000</b>	<b>6,475,000</b>	<b>6,456,000</b>	<b>6,465,000</b>	<b>6,465,000</b>	<b>6,665,000</b>	<b>6,647,000</b>	<b>6,370,000</b>	<b>6,406,000</b>	<b>6,415,000</b>	<b>6,426,000</b>	<b>6,393,000</b>	<b>6,393,000</b>
<b>Maintenance-of-Way</b>																	
Track	1,244,000	1,244,000	1,244,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000
Signals	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000
Bridge and Building	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000
Materials	100,000	200,000	300,000	300,000	300,000	500,000	700,000	900,000	1,100,000	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000
Contract Work	350,000	350,000	850,000	350,000	850,000	350,000	450,000	500,000	700,000	1,400,000	800,000	900,000	900,000	900,000	900,000	1,800,000	800,000
<b>Sub Total</b>	<b>3,442,000</b>	<b>3,542,000</b>	<b>4,142,000</b>	<b>4,099,000</b>	<b>4,599,000</b>	<b>4,099,000</b>	<b>4,399,000</b>	<b>4,649,000</b>	<b>5,049,000</b>	<b>5,949,000</b>	<b>5,649,000</b>	<b>5,649,000</b>	<b>5,649,000</b>	<b>5,649,000</b>	<b>5,649,000</b>	<b>6,649,000</b>	<b>5,649,000</b>
<b>Mechanical</b>																	
Administrative/Labor	1,435,000	1,548,000	1,548,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000
Materials and Minor Repairs	600,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Locomotive Heavy Maintenance					450,000					1,350,000	0					1,280,000	1,000,000
<b>Sub Total</b>	<b>2,035,000</b>	<b>3,048,000</b>	<b>3,048,000</b>	<b>3,200,000</b>	<b>3,650,000</b>	<b>3,200,000</b>	<b>3,200,000</b>	<b>3,200,000</b>	<b>3,200,000</b>	<b>4,550,000</b>	<b>3,200,000</b>	<b>3,200,000</b>	<b>3,200,000</b>	<b>3,200,000</b>	<b>3,200,000</b>	<b>4,480,000</b>	<b>4,200,000</b>
<b>Total</b>	<b>9,452,000</b>	<b>11,765,000</b>	<b>12,395,800</b>	<b>13,102,000</b>	<b>14,708,000</b>	<b>13,774,000</b>	<b>14,055,000</b>	<b>14,314,000</b>	<b>14,714,000</b>	<b>17,164,000</b>	<b>15,495,000</b>	<b>15,219,000</b>	<b>15,255,000</b>	<b>15,284,000</b>	<b>15,284,000</b>	<b>17,927,000</b>	<b>16,242,000</b>
<b>Contingency = 35%</b>	<b>3,308,200</b>	<b>4,114,250</b>	<b>4,336,630</b>	<b>4,585,700</b>	<b>5,147,800</b>	<b>4,820,800</b>	<b>4,919,250</b>	<b>5,009,800</b>	<b>5,149,900</b>	<b>6,007,400</b>	<b>5,423,600</b>	<b>5,325,650</b>	<b>5,339,250</b>	<b>5,344,400</b>	<b>5,344,400</b>	<b>6,134,460</b>	<b>5,684,700</b>
<b>Grand Total</b>	<b>12,760,200</b>	<b>15,879,250</b>	<b>16,732,430</b>	<b>17,687,700</b>	<b>19,855,800</b>	<b>18,594,800</b>	<b>18,974,250</b>	<b>19,323,800</b>	<b>19,863,900</b>	<b>23,171,400</b>	<b>20,918,600</b>	<b>20,544,650</b>	<b>20,593,250</b>	<b>20,628,400</b>	<b>20,628,400</b>	<b>24,061,460</b>	<b>21,926,700</b>
<b>Train Traffic</b>																	
<b>Total DOE-related</b>																	
Train trips (in and return)	232	340	358	406	430	436	428	428	432	440	424	374	390	394	400	384	384
Tons	420,793	527,131	556,036	642,544	711,637	746,307	723,577	728,735	724,501	754,503	733,444	458,920	482,823	485,514	486,709	491,359	491,359
Total trains per week	4	7	7	8	8	8	8	8	8	8	8	7	8	8	8	7	7

## 12.0 Operating and Maintenance Costs

**Table 9. CRC Operating and Maintenance Costs, DOE Only**

		Years 17 through 35																			
Year		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
Operating & Maintenance Costs	<b>Operations</b>																				
	Administrative/ Security	1,863,000	1,478,000	1,478,000	1,478,000	1,478,000	1,478,000	1,478,000	1,478,000	1,478,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	
	Train Crew	2,000,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	1,000,000	1,000,000	1,000,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
	Fuel	1,574,000	1,466,000	1,312,000	1,312,000	1,298,000	1,257,000	1,271,000	1,158,000	846,000	801,000	798,000	796,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000
	Materials/contracts	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
	<b>Sub Total</b>	<b>6,437,000</b>	<b>5,144,000</b>	<b>4,990,000</b>	<b>4,990,000</b>	<b>4,976,000</b>	<b>4,735,000</b>	<b>4,749,000</b>	<b>4,636,000</b>	<b>3,624,000</b>	<b>2,110,000</b>	<b>2,105,000</b>	<b>2,105,000</b>	<b>1,755,000</b>							
	<b>Maintenance-of-Way</b>																				
	Track	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	1,701,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000
	Signals	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	1,425,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000
	Bridge and Building	323,000	323,000	323,000	323,000	323,000	323,000	323,000	323,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000
	Materials	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
	Contract Work	900,000	900,000	900,000	1,400,000	900,000	900,000	900,000	900,000	900,000	1,000,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	850,000	350,000
	<b>Sub Total</b>	<b>5,649,000</b>	<b>5,649,000</b>	<b>5,649,000</b>	<b>6,149,000</b>	<b>5,649,000</b>	<b>5,649,000</b>	<b>5,649,000</b>	<b>5,649,000</b>	<b>3,242,000</b>	<b>1,251,000</b>	<b>1,751,000</b>	<b>1,251,000</b>	<b>1,251,000</b>							
	<b>Mechanical</b>																				
	Administrative/Labor	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	862,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500
	Materials and Minor Repairs	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,400,000	1,400,000	1,400,000	1,400,000	900,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
	Locomotive Heavy Maintenance				1,350,000						150,000					100,000					150,000
	<b>Sub Total</b>	<b>3,200,000</b>	<b>3,200,000</b>	<b>3,200,000</b>	<b>4,550,000</b>	<b>3,200,000</b>	<b>3,100,000</b>	<b>3,100,000</b>	<b>3,100,000</b>	<b>3,100,000</b>	<b>1,912,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>392,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>442,500</b>
<b>Total</b>	<b>15,286,000</b>	<b>13,993,000</b>	<b>13,839,000</b>	<b>15,689,000</b>	<b>13,825,000</b>	<b>13,484,000</b>	<b>13,498,000</b>	<b>13,385,000</b>	<b>8,778,500</b>	<b>3,653,500</b>	<b>3,648,500</b>	<b>3,648,500</b>	<b>3,298,500</b>	<b>3,398,500</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>3,798,500</b>	<b>3,448,500</b>	<b>3,448,500</b>	
<b>Contingency = 35%</b>	<b>5,350,100</b>	<b>4,897,550</b>	<b>4,843,650</b>	<b>5,491,150</b>	<b>4,838,750</b>	<b>4,719,400</b>	<b>4,724,300</b>	<b>4,684,750</b>	<b>3,072,475</b>	<b>1,278,725</b>	<b>1,276,975</b>	<b>1,276,975</b>	<b>1,184,475</b>	<b>1,188,475</b>	<b>1,184,475</b>	<b>1,184,475</b>	<b>1,184,475</b>	<b>1,328,475</b>	<b>1,208,475</b>	<b>1,208,475</b>	
<b>Grand Total</b>	<b>20,636,100</b>	<b>18,890,550</b>	<b>18,682,650</b>	<b>21,180,150</b>	<b>18,663,750</b>	<b>18,203,400</b>	<b>18,222,300</b>	<b>18,069,750</b>	<b>11,850,975</b>	<b>4,932,225</b>	<b>4,925,475</b>	<b>4,925,475</b>	<b>4,482,975</b>	<b>4,587,975</b>	<b>4,482,975</b>	<b>4,482,975</b>	<b>4,482,975</b>	<b>5,127,975</b>	<b>4,656,975</b>	<b>4,656,975</b>	
Train Trips	<b>Total DOE-related</b>																				
	Train trips (in and return)	404	356	288	288	241	272	272	222	84	64	62	62	52	52	52	52	52	52	52	
	Tons	499,946	459,841	372,885	374,372	362,908	355,364	348,965	264,447	66,467	35,116	33,910	33,910	29,145	29,145	29,145	29,145	29,145	29,145	29,145	
	Total trains per week	8	7	6	6	5	5	5	4	2	1	1	1	1	1	1	1	1	1	1	

## 12.0 Operating and Maintenance Costs

**Table 9. CRC Operating and Maintenance Costs, DOE Only**

		Years 36 through 50																
Year		36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	Total	
Operating & Maintenance Costs	<b>Operations</b>																	
	Administrative/ Security	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	509,000	54,705,000
	Train Crew	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	46,800,000
	Fuel	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	446,000	50,298,800
	Materials/contracts	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	35,400,000
	<b>Sub Total</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>1,755,000</b>	<b>187,003,800</b>
	<b>Maintenance-of-Way</b>																	
	Track	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000	50,154,000
	Signals	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	285,000	41,610,000
	Bridge and Building	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	9,208,000
	Materials	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	28,100,000
	Contract Work	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	850,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	30,650,000
	<b>Sub Total</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,751,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>1,251,000</b>	<b>901,000</b>	<b>159,722,000</b>
	<b>Mechanical</b>																	
	Administrative/Labor	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	262,500	47,656,000
	Materials and Minor Repairs	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	36,420,000
	Locomotive Heavy Maintenance					150,000						150,000						6,100,000
	<b>Sub Total</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>442,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>442,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>292,500</b>	<b>262,500</b>	<b>90,176,000</b>
	<b>Total</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>3,448,500</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>3,798,500</b>	<b>3,298,500</b>	<b>3,448,500</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>3,298,500</b>	<b>2,918,500</b>	<b>436,901,800</b>
	<b>Contingency = 35%</b>	<b>1,154,475</b>	<b>1,154,475</b>	<b>1,154,475</b>	<b>1,154,475</b>	<b>1,208,975</b>	<b>1,154,475</b>	<b>1,154,475</b>	<b>1,154,475</b>	<b>1,329,475</b>	<b>1,154,475</b>	<b>1,208,975</b>	<b>1,154,475</b>	<b>1,154,475</b>	<b>1,154,475</b>	<b>1,154,475</b>	<b>1,021,475</b>	<b>182,916,630</b>
<b>Grand Total</b>	<b>4,452,975</b>	<b>4,452,975</b>	<b>4,452,975</b>	<b>4,452,975</b>	<b>4,655,475</b>	<b>4,452,975</b>	<b>4,452,975</b>	<b>4,452,975</b>	<b>5,127,975</b>	<b>4,452,975</b>	<b>4,655,475</b>	<b>4,452,975</b>	<b>4,452,975</b>	<b>4,452,975</b>	<b>4,452,975</b>	<b>3,939,975</b>	<b>689,817,430</b>	
Train Traffic	<b>Total DOE-related</b>																	
	Train trips (in and return)	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	10,055	
	Tons	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	29,145	13,521,554	
	Total trains per week	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

## 13.0 References and Applicable Documents

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**Appendix A**  
**Responsibilities of a Common Carrier Railroad**

## Surface Transportation Board

The STB is an independent regulatory body organizationally housed within the U.S. Department of Transportation. The STB was established pursuant to the Interstate Commerce Commission (ICC) Termination Act of 1995, Public Law No. 104-88, to assume certain of the regulatory functions that had previously been administered by the ICC. The STB has broad economic regulatory oversight of railroads, addressing such matters as rates, service, construction, acquisition and abandonment of rail lines, carrier mergers, trackage rights, and interchange among carriers. The authority is contained within 49 USC 10101-11908.

### Common Carrier Obligation

Common carrier Railroads have an obligation to provide rail service upon reasonable request. Railroads can provide that service under rates and service terms agreed to in a confidential transportation contract with the shipper (49 USC 10709) or under openly available common carriage rates and service terms (49 USC 11101). Rates and service terms established by contract are not subject to STB regulation, except for limited protections against discrimination involving agricultural products.

### Rate Disclosure Requirements

A railroad's common carriage rates and service terms must be disclosed upon request and advance notice given for increases in common carriage rates or changes in service terms. If a railroad does not have a rate in place to move a shipper's traffic, it must promptly establish a rate and service terms upon the shipper's reasonable request.

### Market Dominance

Market dominance refers to "an absence of effective competition from other rail carriers or modes of transportation for the transportation to which a rate applies." The STB is empowered to adjudicate complaints challenging the reasonableness of a common carriage rate only if the railroad has market dominance over the traffic involved (49 USC 10701(c)-(d), 10704, and 10707). The STB cannot find that the carrier has market dominance over a movement if the rate charged results in a revenue-to-variable cost percentage that is less than 180 percent, based on the STB's Uniform Rail Costing System.

### Annual Railroad Reporting to the STB

Only Class I railroads (those with annual revenues of at least \$272.0 million) are required to file financial and operating data (R-1 Report) annually with the STB.

### Regulatory Considerations Regarding Shared vs. Exclusive Use of the NRL

A question central to the development of the NRL is, should the proposed rail line be operated for common carriage or used as private track? If operated as a common carrier, the DOE, or its designated operator, is obligated to provide service to any and all shippers along the line that request service or may want service in the future (49 USC [U.S. Code] 11101a). If operated as a common carrier, the NRL would be subject to the Interstate Commerce Act's regulatory provisions in 49 USC 10901 and therefore require authorization by the STB.

On the other hand, if the NRL is operated as private track, the DOE would not be subject to any aspect of the STB's jurisdiction. The term "private track" is not defined in the Interstate Commerce Act, but has been described by Congress to mean "non-railroad companies who construct rail lines to serve their own facilities [exclusively]..." Without STB jurisdiction, the NRL would be subject to existing and yet-to-be passed state and local environmental regulations.

The introduction of additional rail traffic on the NRL would not be expected to have any safety concerns. Waste shipments are made to the NRL over the national transportation network. During this movement, the casks would be around far more other rail cars than would be introduced as part of commercial traffic on the NRL. The presence of additional traffic would also not be expected to cause any additional issues with respect to train dispatching or scheduling delays than would normally occur while on the national transportation network.

### State Jurisdiction of NRL

Should the NRL be operated as a private, intrastate, non-common carrier rail line, the FRA defines such a line as part of the national railroad network. As such, NRL is subject to FRA safety regulations and its preemptive provisions over state regulation. The Nevada Public Utilities Commission does employ certified railroad inspectors for its program administered in conjunction with the FRA for four of the five safety disciplines (excluding signal and train control).

Section 205 of the FRA Act of 1970 indicates that states may adopt a more stringent rule or regulation only if it meets three tests: (1) it is necessary to eliminate an essentially local safety hazard; (2) it is not incompatible with any law or regulation of the federal government; and (3) it is not an unreasonable burden on interstate commerce. Nevada does have some rail safety regulations contained in NAC 703, 704, and 705, involving clearance areas around tracks and walkways for railroad employees.

In regard to ancillary facilities such as, yards, and spur tracks, over which the STB does not have licensing authority, the STB preemption powers contained in 49 USC 10501(b) preclude state or local interference with the operation of the national railroad network. Nevertheless, railroads can be required to observe generally applicable, non-discriminatory local fire, health, safety, and construction regulations that do not restrict the railroad from conducting its operations or unreasonably burden interstate commerce.

In terms of highway-rail crossings, the Federal Highway Administration (FHWA) provides standards for warning systems in the *Manual for Uniform Traffic Control Devices* (FHWA 2004) with state participation in the process. States are authorized by 23 USC 130 to determine crossings in need of upgrade with federal funding assistance.

**Appendix B**  
**Estimated Gross Tons by Category for Nevada Rail Line**

**Table B-1. Estimated Gross Tons by Category by Year  
for the NRL - Loaded and Empty Trains**

Year	Commercial		DOE	Navy	SSC/WP	Repository Construct'n	Fuel Oil	Commerc'l Shared Use	TOTAL
	SNF	HLW	SNF						
1	26,809	43,195	3,376	3,229	55,266	266,874	19,982	830,263	1,248,995
2	71,887	84,702	6,753	3,229	60,182	266,874	28,908	1,227,008	1,749,543
3	91,146	84,702	15,194	5,478	64,249	266,874	28,908	1,480,102	2,036,653
4	164,812	84,702	23,635	5,478	69,841	266,874	28,908	1,655,862	2,300,112
5	219,016	84,702	30,388	10,955	74,906	266,874	28,908	1,872,768	2,588,518
6	253,864	84,702	26,215	12,685	75,075	266,874	28,908	1,872,768	2,621,091
7	227,356	84,702	30,088	13,435	74,568	266,874	28,908	1,872,768	2,598,699
8	228,845	84,702	30,584	14,184	75,075	266,874	28,908	1,872,768	2,601,941
9	216,832	93,936	30,584	14,184	75,587	266,874	28,908	1,872,768	2,599,674
10	220,009	116,966	30,584	14,184	79,823	266,874	28,908	1,872,768	2,630,117
11	220,009	116,966	30,584	14,184	58,825	266,874	28,908	1,872,768	2,609,119
12	224,675	116,966	30,584	14,184	47,221		28,908	1,872,768	2,335,307
13	240,362	123,817	30,584	14,184	49,091		28,908	1,872,768	2,359,714
14	235,696	128,682	32,768	14,184	48,922		28,908	1,872,768	2,361,929
15	229,341	133,051	37,138	13,435	49,941		28,908	1,872,768	2,364,582
16	237,185	136,725	37,532	13,435	41,787		28,908	1,872,768	2,368,340
17	233,015	136,725	42,398	13,435	50,622		28,908	1,872,768	2,377,871
18	254,360	77,249	42,398	13,435	43,995		28,908	1,872,768	2,333,113
19	244,532		42,398	13,435	40,430		28,908	1,872,768	2,242,471
20	246,021		42,398	13,435	40,599		28,908	1,872,768	2,244,129
21	233,511		42,894	13,435	40,599		28,908	1,872,768	2,232,116
22	232,022		42,894	13,435	35,672		28,908	1,872,768	2,225,700
23	237,681		42,894		37,372		28,908	1,872,768	2,219,624
24	161,135		44,582		29,388		28,908	1,872,768	2,136,781
25	28,196				9,004		28,908	1,872,768	1,938,877
26					5,946		28,908	1,872,768	1,907,623
27					4,589		28,908	1,872,768	1,906,266
28					4,589		28,908	1,872,768	1,906,266
29							28,908	1,872,768	1,901,677
30							28,908	1,872,768	1,901,677
31							28,908	1,872,768	1,901,677
32							28,908	1,872,768	1,901,677
33							28,908	1,872,768	1,901,677
34							28,908	1,872,768	1,901,677
35							28,908	1,872,768	1,901,677
36							28,908	1,872,768	1,901,677
37							28,908	1,872,768	1,901,677
38							28,908	1,872,768	1,901,677
39							28,908	1,872,768	1,901,677
40							28,908	1,872,768	1,901,677
41							28,908	1,872,768	1,901,677
42							28,908	1,872,768	1,901,677
43							28,908	1,872,768	1,901,677
44							28,908	1,872,768	1,901,677
45							28,908	1,872,768	1,901,677
46							28,908	1,872,768	1,901,677
47							28,908	1,872,768	1,901,677
48							28,908	1,872,768	1,901,677
49							28,908	1,872,768	1,901,677
50							28,908	1,872,768	1,901,677
<b>TOTAL</b>	<b>4,978,315</b>	<b>1,817,189</b>	<b>769,446</b>	<b>261,260</b>	<b>1,343,163</b>	<b>2,935,618</b>	<b>1,436,479</b>	<b>91,340,583</b>	<b>104,882,053</b>

Note: These figures represent mid-range estimates for commercial, shared-use traffic.

Table B-2. Commercial Shared Use Traffic - Nevada Rail Line

Year	Caliente Team Track		Tonopah T.T.		Amargosa Valley T.T.		Ponderosa Dairy A.V.		Pinoche - Natural Poz		Y.Mt. Cind-R-Lite		US Ecology Beatty		D&H Mining Beatty		Farland Refin Wrm Sprngs		Dry Lake V. Power		Total	
	Tons	Carloads	Tons	Carloads	Tons	Carloads	Tons	Carloads	Tons	Carloads	Tons	Carloads	Tons	Carloads	Tons	Carloads	Tons	Carloads	Tons	Carloads	Tons	Carload
1	10,000	100	2,000	20	2,000	20	15,000	150	100,000	1,000	15,000	150	50,000	500	50,000	500	200,000	2,000	0	0	444,000	4.4
2	20,000	200	4,000	40	4,000	40	30,000	300	150,000	1,500	30,000	300	75,000	750	100,000	1,000	250,000	2,500	0	0	663,000	6.6
3	30,000	300	6,000	60	6,000	60	40,000	400	150,000	1,500	45,000	450	100,000	1,000	150,000	1,500	270,000	2,700	0	0	797,000	7.9
4	40,000	400	8,000	80	8,000	80	45,000	450	150,000	1,500	50,000	500	125,000	1,250	200,000	2,000	275,000	2,750	0	0	901,000	9.0
5	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
6	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
7	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
8	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
9	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
10	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
11	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
12	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
13	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
14	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
15	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
16	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
17	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
18	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
19	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
20	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
21	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
22	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
23	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
24	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
25	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
26	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
27	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
28	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
29	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
30	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
31	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
32	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
33	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
34	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
35	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
36	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
37	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
38	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
39	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
40	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
41	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
42	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
43	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
44	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
45	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
46	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
47	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
48	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
49	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
50	48,000	480	12,000	120	12,000	120	50,000	500	150,000	1,500	54,000	540	153,750	1,538	254,000	2,540	295,597	2,956	0	0	1,029,347	10.2
TOTAL	2,308,000	23,080	572,000	5,720	572,000	5,720	2,430,000	24,300	7,450,000	74,500	2,624,000	26,240	7,422,500	74,225	12,184,000	121,840	14,592,462	145,925	0	0	50,154,962	501.5

**Appendix C**  
**Assumptions for Determining Numbers of Trains**

Table C-1. Assumptions for Determining Number of Trains

YEAR	CATEGORY	TRAINS	MOVEMENTS
1	CSNF	10	3 cars/train - initial start-up at commercial plants
	HLW	20	1-2 cars/train - run-up phase
	DSNF	2	Single movements - not combinable because of few other weekly movements
	NAVY	1	3 cars/train; combined at origin
	SSC+WP	33	SSC+(WP+2)=227 cars+ 7 cars/train=33 trains
2	CSNF	27	3 cars/train - commercial activity still gearing up
	HLW	39	2 cars/train; assumed to be evenly spaced through the year
	DSNF	4	Single movements - not combinable because of few other weekly movements
	NAVY	1	3 cars/train; combined at origin
	SSC+WP	36	SSC+(WP+2)=247 cars+ 7 cars/train=36 trains
3	CSNF	29	4 cars/train - more opportunity to combine trains/operations becoming routine
	HLW	39	2 cars/train; assumed to be evenly spaced through the year
	DSNF	9	Single movements - not combinable because of few other weekly movements
	NAVY	1	6 cars/train, maximum; combined at origin
	SSC+WP	38	SSC+(WP+2)=265 cars+ 7 cars/train=38 trains
4	CSNF	45	45 cars/train - more casks becoming available
	HLW	39	2 cars/train; assumed to be evenly spaced through the year
	DSNF	14	Single movements - not combinable because of few other weekly movements
	NAVY	1	6 cars/train, maximum; combined at origin
	SSC+WP	41	SSC+(WP+2)=288 cars+ 7 cars/train=41 trains
5	CSNF	53	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	39	2 cars/train; assumed to be evenly spaced through the year
	DSNF	18	Single movements - not combinable because of few other weekly movements
	SSC+WP	41	SSC+(WP+2)=322 cars+ 8 cars/train=41 trains (WP trains becoming more efficient)
	6	CSNF	61
HLW		39	2 cars/train; assumed to be evenly spaced through the year
DSNF		12	2 cars/train; more cars available
NAVY		3	3 trains (not exceeding 6 cars each: 5+5+3=13)
SSC+WP		41	SSC+(WP+2)=323 cars+ 8 cars/train=41 trains
7	CSNF	56	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	39	2 cars/train; assumed to be evenly spaced through the year
	DSNF	14	2 cars/train; more cars available
	NAVY	3	3 trains (not exceeding 6 cars each: 5+5+4=14)
	SSC+WP	40	SSC+(WP+2)=320 cars+ 8 cars/train=40 trains

Table C-1. Assumptions for Determining Number of Trains

YEAR	CATEGORY	TRAINS	MOVEMENTS
8	CSNF	55	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	39	2 cars/train; assumed to be evenly spaced through the year
	DSNF	14	2 cars/train; more cars available
	NAVY	3	5 cars/train=3 trains; evenly distributed through the year
	SSC+WP	41	SSC+(WP+2)=323 cars+ 8 cars/train=41 trains
9	CSNF	52	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	43	2 cars/train; assumed to be evenly spaced through the year
	DSNF	14	2 cars/train; more cars available
	NAVY	3	5 cars/train=3 trains; evenly distributed through the year
	SSC+WP	41	SSC+(WP+2)=323 cars+ 8 cars/train=41 trains
10	CSNF	53	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	44	3 cars/train; becoming more efficient, not combinable with other trains
	DSNF	14	2 cars/train; more cars available
	NAVY	3	5 cars/train=3 trains; evenly distributed through the year
	SSC+WP	43	SSC+(WP+2)=342 cars+ 8 cars/train=43 trains
11	CSNF	53	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	44	3 cars/train; not combinable with other trains
	DSNF	14	2 cars/train; more cars available
	NAVY	3	5 cars/train=3 trains; evenly distributed through the year
	SSC+WP	35	SSC+(WP+2)=242 cars+ 7 cars/train=35 trains
12	CSNF	54	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	44	3 cars/train; not combinable with other trains
	DSNF	14	2 cars/train; more cars available
	NAVY	3	5 cars/train=3 trains; evenly distributed through the year
	WP	46	3 cars/train
13	CSNF	53	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	46	3 cars/train; not combinable with other trains
	DSNF	14	2 cars/train; more cars available
	NAVY	3	5 cars/train=3 trains; evenly distributed through the year
	WP	48	3 cars/train
14	CSNF	57	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	48	3 cars/train; not combinable with other trains
	DSNF	15	2 cars/train; more cars available
	NAVY	3	5 cars/train=3 trains; evenly distributed through the year
	WP	48	3 cars/train
15	CSNF	55	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	50	3 cars/train; not combinable with other trains
	DSNF	17	2 cars/train; more cars available
	NAVY	3	5 cars/train=3 trains; evenly distributed through the year
	WP	49	3 cars/train

Table C-1. Assumptions for Determining Number of Trains

YEAR	CATEGORY	TRAINS	MOVEMENTS
16	CSNF	57	6 cars/train (the design train); assumed to be evenly distributed through the year
	HLW	51	3 cars/train; not combinable with other trains
	DSNF	14	2 cars/train; more cars available
	NAVY	3	5 cars/train=3 trains; evenly distributed through the year
	WP	41	3 cars/train
<b>FUTURE YEARS' OPERATIONS</b>			
YEARS	CATEGORY	TRAINS	MOVEMENTS
17 – 25	CSNF	53	6 cars/train; same as Year 5
17 – 18	HLW	44	3 cars/train; same as Year 10
17 – 24	DSNF	40	3 cars/train; casks becoming more available
17 – 22	NAVY	3	5 cars/train; same as Year 8
17 – 28	WP	46	3 cars/train; same as Year 12
<b>Fuel Oil Trains</b>			6-7 cars/train; seasonal
<b>Repository Construction</b>			40 cars/train; 4,000 tons
<b>COMMERCIAL TRAINS</b>			
Year	Activity		Cars
1	3 trains/week; alternate days, except Sundays		29
2	4 trains/week; alternate days, except Sundays		32
3	5 trains/week; alternate days, except Sundays		31
4	5 trains/week; alternate days, except Sundays		35
5 to 50	5 trains/week; daily, except Saturdays and Sundays		40
10 to 11	5 trains/week; alternate days, except Sundays		45
12 to 50	6 trains/week; alternate days, except Sundays		45

Notes: CSNF = Commercial Spent Nuclear Fuel  
DSNF = Defense Spent Nuclear Fuel

**Appendix D**  
**Train Meet Locations Caliente to Yucca Mountain**

Time-Distance Plot

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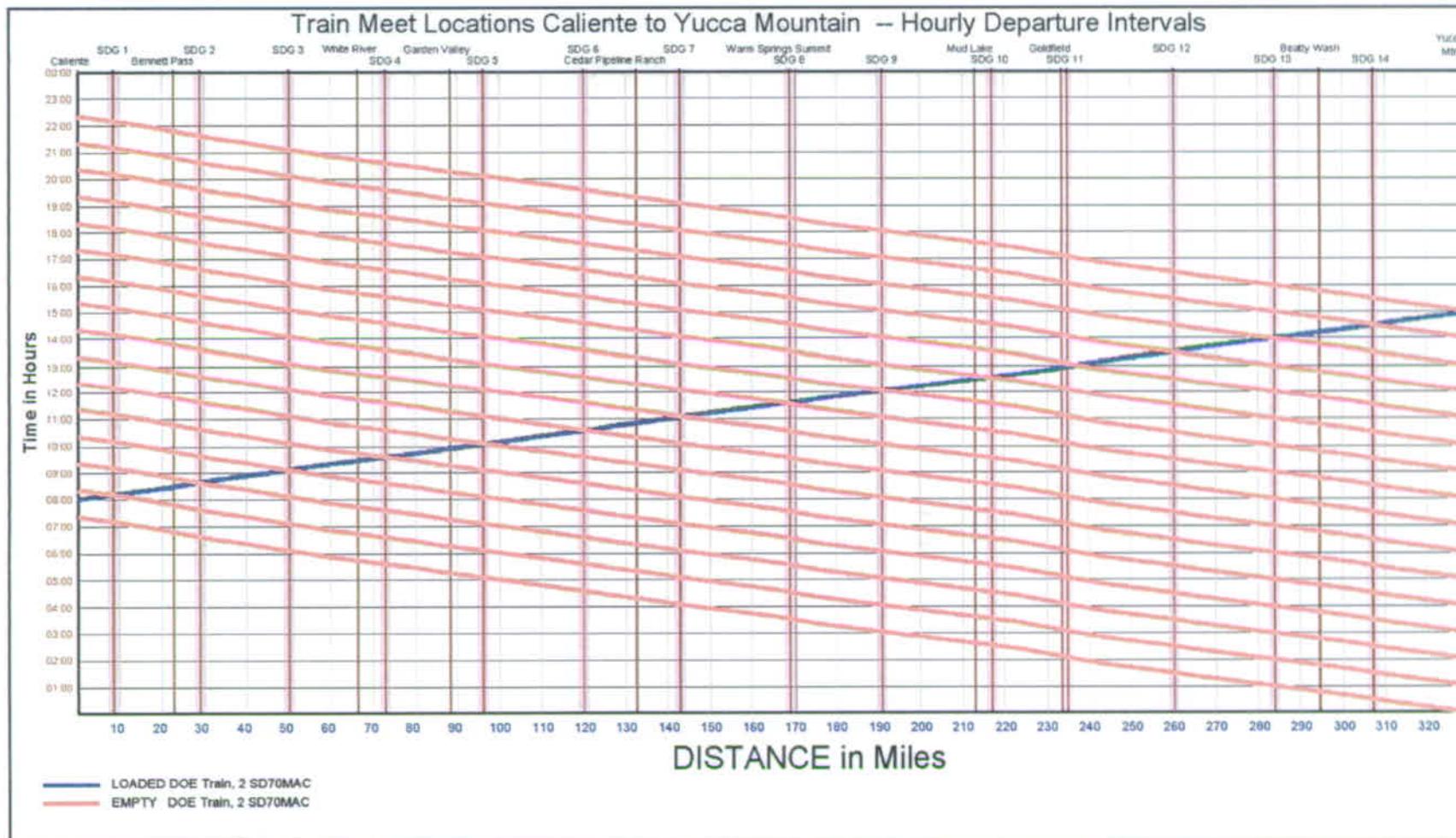


Figure D-1. Train Meet Locations, Caliente to Yucca Mountain

**Appendix E**  
**Consideration for Fencing along the Nevada Rail Line**

## Consideration for Fencing along the Nevada Rail Line

Prepared by Nevada Rail Partners – February 2005 (Updated April 2006)

Document No. T05-00144-O-SYSW-CP-0003-00

### Introduction

The NTRD (BSC 2005a) calls for new fencing along, and parallel to, the railroad only as government agencies require. These requirements would include areas through existing towns and/or cities, state or federal lands. Fencing may also be necessary where the NRL crosses limited parcels of private property.

### Industry Practice

Today's Class 1 railroads selectively install fencing along their lines due to issues related to safety, liability, cost, property delineation, accessibility, and snow-drift prevention. Sometimes the fence is on only one side of the tracks; usually if there is a fence it exists on both sides. The fences generally lie on or near the ROW line, but may vary up to 50 feet or more from the formal boundary. Barbed-wire fences with steel posts are the most common type (such as "UPRR Standard Barbed Wire Fence, Std. Dwg. No.75"), although chain-link fences and other types may exist in cities. Sometimes the railroad constructs and maintains the fence; other times the adjacent property owner or lessee will perform those functions. Some railroad fences date back to the turn of the century. More details on these issues above include the following:

### Safety

Fences increase safety by helping to prevent people, animals and livestock from venturing into the ROW and being struck by trains.

### Liability

Fences can either increase or decrease liability to the railroad. If no fences exist, courts may hold the railroad liable for accidents for not having installed a fence. If fences exist in some locations but not in others, courts may hold the railroad liable for setting an uneven precedent, or for not being consistent in maintaining safety. A similar liability could exist if fences exist but suffer damage, and an accident occurs because the railroad did not repair the damaged fence quickly enough.

### Cost

Fences are expensive for the railroad to construct and maintain. If NRL fencing costs \$2 per lineal foot, for example, the construction cost alone to the project would be over \$6.8 million.

### Property Delineation

Fences help the railroad mark its property and proclaim to adjacent property owners/users/trespassers "This is my property; do not enter here." This is particularly important in urban areas where adjacent owners may construct buildings or other facilities next to railroad property. Some adjacent property owners will build on railroad land if no fence exists to delineate the boundary.

### Accessibility

Sometimes railroads will not install fencing to allow adjacent property owners/users to cross railroad property at their own risk. A prime example would be tracks that cross public or private lands where cattle graze and move about frequently, known as "open range." Fencing the tracks would not permit the ranchers and the cattle as much flexibility. The opposite of accessibility would be the lack of access, where the railroad specifically prevents this freedom of movement. Such a case might take place where trains have killed cattle on the open range and the ranchers had sued for excessive damages; later the railroad may install fences to prevent future losses.

### Snow-Drift Prevention

Some railroads in lands that receive considerable snowfall may install snow fences to help prevent blowing snow from accumulating on the tracks. It is particularly important to keep snow and ice out of turnout components in order to prevent derailments (switch heaters can also perform that same function). Snow fences are usually just on the side of the rail line from which the wind blows. The region of the NRL that may be subject to regular blowing snow would be from Caliente (or other east-end connection) west to the Goldfield vicinity.

### Conclusion

The foregoing outline depicted the advantages and disadvantages of railroad fencing. Advantages of fencing include increased safety, reduced liability, enhanced property delineation, reduced accessibility where the railroad wants to restrict it, and increased snow-drift protection. Disadvantages of installing fencing would be liability related to fence maintenance, increased project cost, and reduced accessibility where the railroad may not wish to restrict it. The safety and property delineation advantages via fencing along the ROW would have very limited benefits in the remote areas that NRL would traverse. Not fencing the ROW would reduce project costs, and allow open range accessibility. NRL can, in addition, later install either standard barbed-wire fencing or snow-drift fencing only in those areas with problems identified after operations on the railroad begin.

**Appendix F**  
**Bridge Loading Analysis**

## Conceptual Railroad Structure Loading Analysis

Issued as Special Analysis to Support Route Sections and Structures Activities (NRP 2007c)

Revised 3/3/2006; 4/6/2006

### Introduction

This analysis is a supplement to the initial loading analysis performed in 2004. The intent is to determine the impact of the revised car loadings on the project's railroad bridges. The proposed train consists, and some of the locomotives/cars that make up those consists, have been modified since the original load analysis. In this analysis, the computer modeling used two SD70ACe (4300 hp) locomotives to pull train consists comprised of DOE cask cars (264 tons) or Navy cask cars (394.5 tons), buffer cars (80 tons), and an escort car (80 tons). The locomotives and cars and the two train consist scenarios are diagrammed on the final sheet of this appendix. The two train consist scenarios also described below.

### Consist D6

Two SD70ACe locomotives – 70-foot buffer car appropriately loaded - 6 loaded DOE or Navy cask cars - 70-foot buffer car appropriately loaded - four axle escort car. No buffer cars were placed between the cask cars.

### Consist D6b

Two SD70ACe locomotives - 70-foot buffer car appropriately loaded - 6 loaded DOE or Navy cask cars with a 70-foot buffer car appropriate loaded between each - 70-foot buffer car appropriately loaded - four axle escort car.

The proposed DOE car, with its revised estimated gross load of 264 tons, does not create a load equivalent greater than a Cooper's E-80 for moment or shear on simple spans with lengths between eight and 400 feet (bearing to bearing), with or without the use of interior buffer cars between the cask cars. In general, the equivalent loading was found to be higher when buffer cars were not utilized between the loaded cask cars.

The 12-axle Navy flat car, with its revised gross weight of 394.5 tons, was also reviewed utilizing similar train consist combinations to those reviewed for the proposed DOE train consist. . The proposed Navy car does create a load equivalent greater than a Cooper's E-80 load for span lengths greater than 160 feet (bearing to bearing) when buffer cars were not used between the cask cars. The maximum equivalent Cooper's load reached E-96 for the design moment of simple spans of 400 feet. However, if buffer cars are added between the loaded Navy cars, the equivalent Cooper's load reduces to less than E-80 for the entire range of spans (8 to 400 ft).

Again, from a loading standpoint, there is no difference between operating at 45 mph and 79 mph. However, the combination of loads and locomotives proposed would not be able to operate at the higher speed given the proposed grade and curvature on the project. In addition, most railroads restrict special heavy load cars to a maximum speed of 45 mph due to safety concerns. The DOE and Navy cask car loadings would still need to be reviewed by each railroad on each proposed route to verify that the track and structures could withstand the proposed train consist. Railroads have a significant number of older steel spans with overall design ratings less than Cooper's E-65.

Current industry hauling practices indicate that most train consists create or are below an Cooper's E-65 equivalent loading, with rare occurrences of consists near the full Cooper's E-80 design load. A special design load for coal cars was created for steel span under 50 feet. Under these conditions, there is approximately 20 percent reserve capacity under normal load conditions. If the D6b Navy consist is a regular train, the equivalent Cooper's load approaches E-77 for a range of moderate span lengths (35 to

120 feet), which would nearly max the structures out on a regular basis and cause increased maintenance and fatigue wear concerns. The analysis suggests that if a significant number of trains hauling Navy cask cars with buffers (D6b consist) are being considered, then loading for bridges along the routes should be higher than a Cooper's E-80, loading in the Cooper's E-90 range. Designing for Cooper's E-90, conceptually, does not appear to significantly increase span costs.

The previous simulations were validated against the AAR's Fortran-based load rating program, including an independent run by AAR staff in Pueblo. The software uses an Excel Spreadsheet in conjunction with a visual basic macro to step the various trains across the various span lengths.

The following sheets contain tables with the Span Length, Equivalent Moment, and Shear Rating created by the train consists analyzed. A graph is included for each scenario depicting the tabled values.

**DOE Consist D6**

Two SD70ACe locomotives – 70-foot buffer car appropriately loaded - 6 loaded DOE cars - 70-foot buffer car appropriately loaded - four axle escort car.

Span Length (feet)	Moment Rating (E-)	Shear Rating (E-)
8	68.0	60.2
10	60.5	61.7
12	56.7	56.7
13	54.4	57.6
14	54.0	58.6
15	55.4	59.3
16	56.6	58.2
18	58.2	56.7
20	57.6	58.2
25	57.9	59.5
30	58.9	58.7
35	58.7	59.1
40	57.8	59.9
45	57.6	60.7
50	58.6	62.2
60	61.0	64.1
70	61.7	62.4
80	60.9	59.2
90	59.1	56.2
100	57.1	53.4
120	51.3	51.6
140	46.8	51.4
160	45.7	52.2
180	45.7	52.0
200	46.5	51.2
225	47.3	51.0
250	48.9	51.4
275	50.6	51.7
300	51.3	51.3
350	51.0	51.6
400	51.5	51.6
<b>Maximum</b>	<b>68.0</b>	<b>64.1</b>

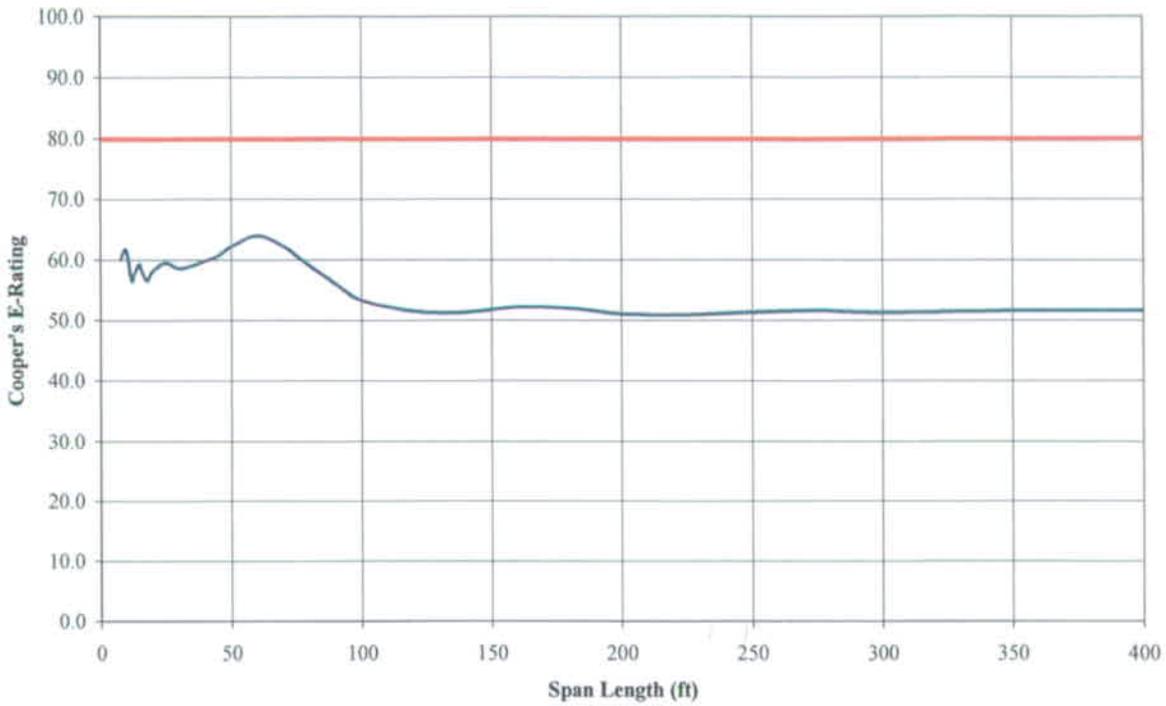


Figure F-1. Shear Rating-DOE D6 Consist

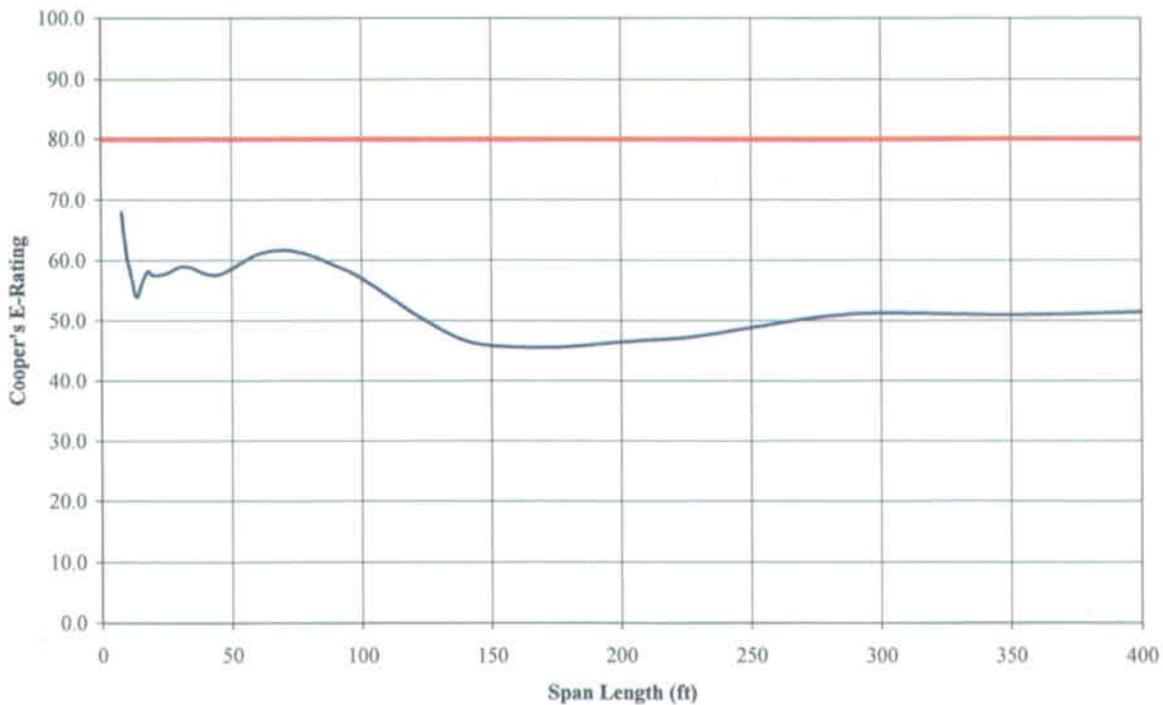


Figure F-2. Moment Rating-DOE D6 Consist

**DOE Consist D6b**

Two SD70ACe locomotives – 70-foot buffer car appropriately loaded - 6 loaded DOE cask cars with a 70-foot buffer car appropriate loaded between each - 70-foot buffer car appropriately loaded - four axle escort car.

Span Length (feet)	Moment Rating (E-)	Shear Rating (E-)
8	68.0	58.0
10	60.5	60.4
12	56.7	56.1
13	54.3	56.6
14	54.0	57.7
15	55.4	58.5
16	56.5	57.4
18	58.2	55.9
20	57.6	57.2
25	57.9	58.9
30	58.9	58.2
35	58.7	57.3
40	56.8	56.7
45	55.8	55.9
50	55.0	55.4
60	53.5	54.9
70	52.1	52.3
80	50.5	49.7
90	48.5	48.9
100	46.7	48.4
120	45.0	47.8
140	43.8	46.3
160	44.3	44.8
180	44.8	44.1
200	44.7	44.3
225	44.0	43.8
250	43.1	43.3
275	42.9	43.4
300	42.9	43.3
350	42.5	42.8
400	42.3	42.6
<b>Maximum</b>	<b>68.0</b>	<b>60.4</b>

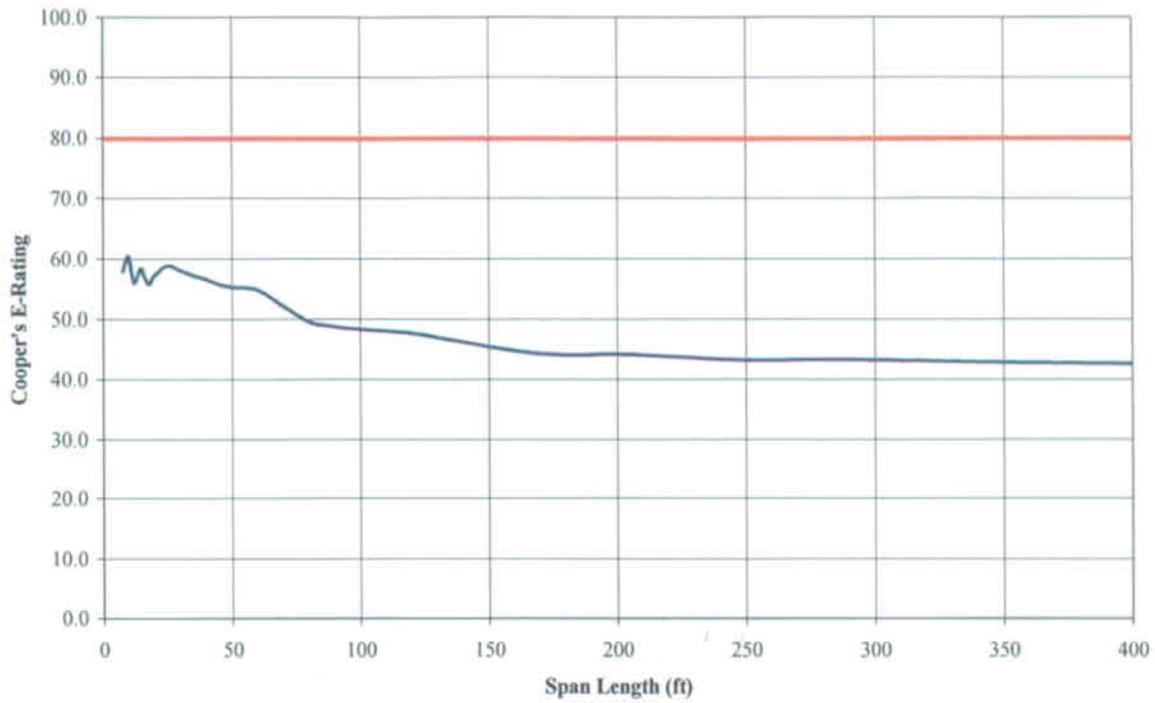


Figure F-3. Shear Rating-DOE D6b Consist

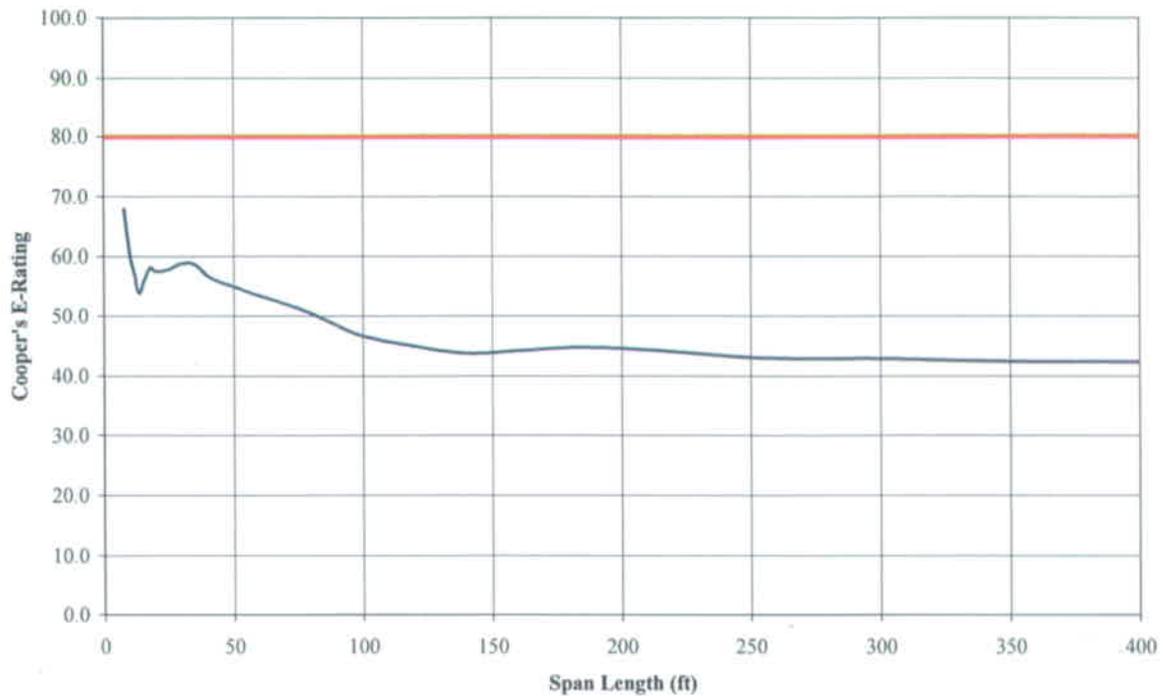


Figure F-4. Moment Rating-DOE D6b Consist

**Navy Consist D6**

Two SD70ACe locomotives – 70-foot buffer car appropriately loaded - 6 loaded Navy cars - 70-foot buffer car appropriately loaded - four axle escort car.

Span Length (feet)	Moment Rating (E-)	Shear Rating (E-)
8	68.9	69.0
10	70.9	68.1
12	65.6	65.8
13	62.5	65.8
14	63.0	65.8
15	63.3	65.9
16	63.5	65.9
18	63.9	65.9
20	63.5	65.9
25	66.9	68.6
30	69.7	68.9
35	72.6	69.9
40	72.8	69.9
45	71.9	70.0
50	72.6	71.4
60	73.2	74.5
70	74.3	75.9
80	76.6	75.1
90	77.3	74.9
100	79.0	75.2
120	79.7	76.6
140	79.5	78.0
160	80.7	79.4
180	82.7	80.5
200	84.8	81.6
225	86.8	83.0
250	89.0	84.0
275	90.8	85.0
300	92.1	85.9
350	94.2	87.4
400	95.5	88.6
<b>Maximum</b>	<b>95.5</b>	<b>88.6</b>

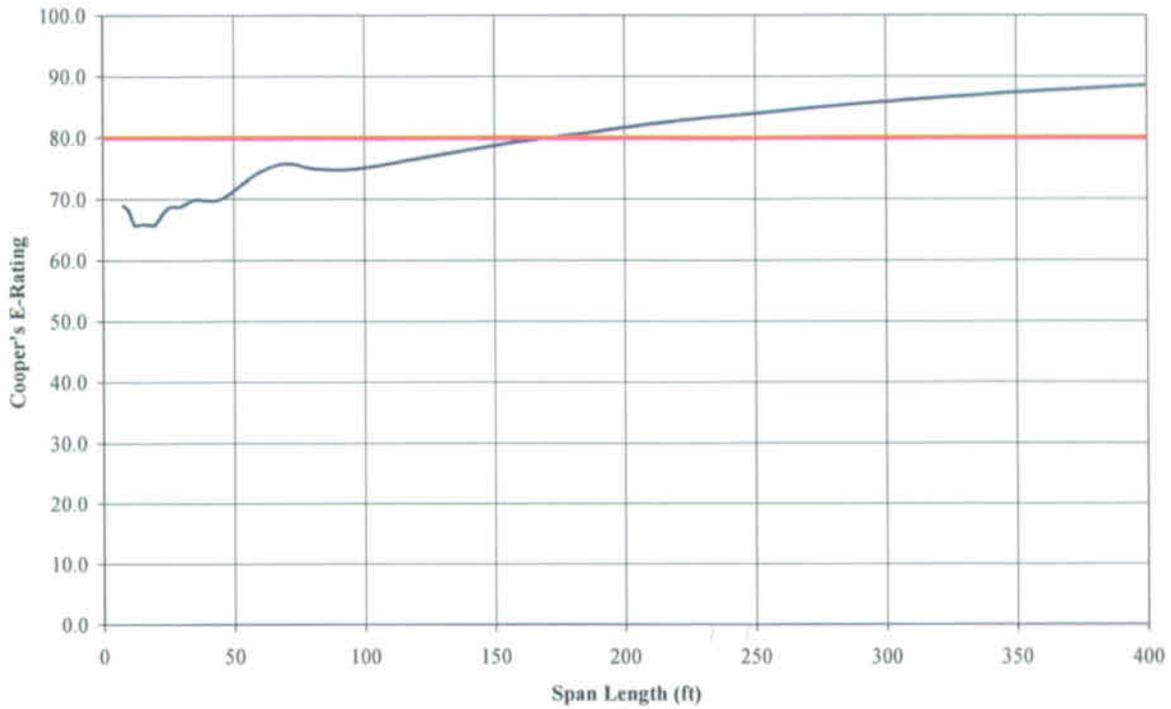


Figure F-5. Shear Rating-Navy D6 Consist

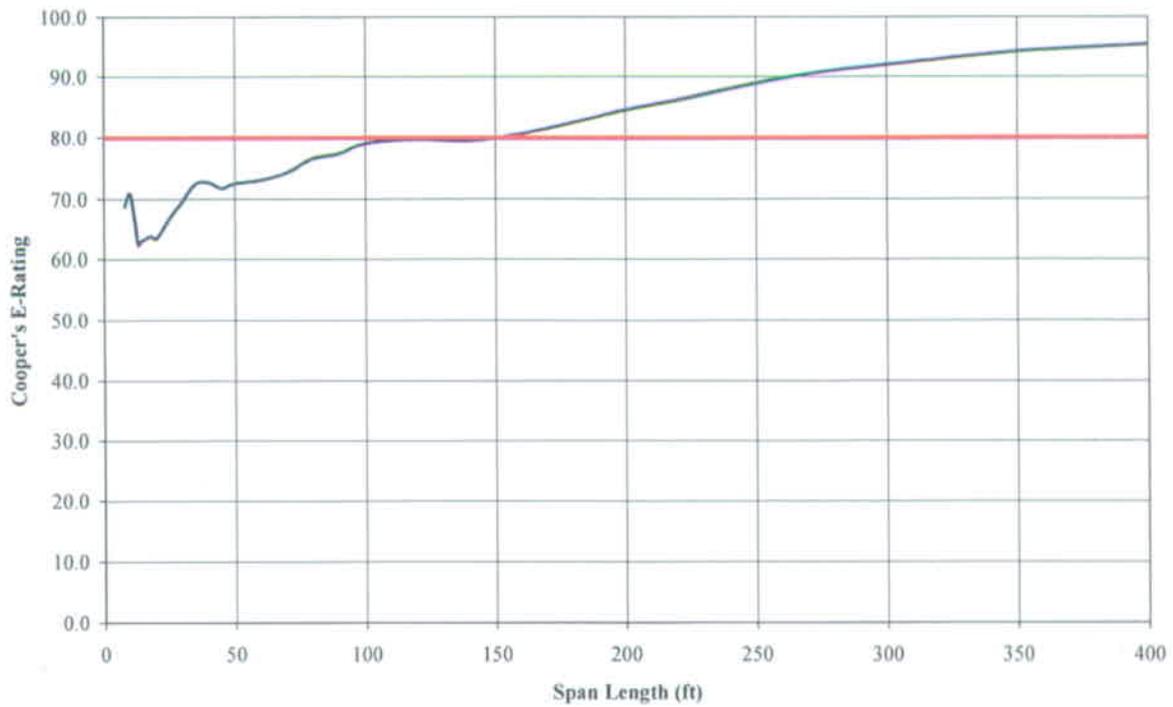


Figure F-6. Moment Rating-Navy D6 Consist

**Navy Consist D6b**

Two SD70ACe locomotives – 70-foot buffer car appropriately loaded - 6 loaded Navy cask cars with a 70-foot buffer car appropriate loaded between each - 70-foot buffer car appropriately loaded - four axle escort car.

<b>Span Length (feet)</b>	<b>Moment Rating (E-)</b>	<b>Shear Rating (E-)</b>
8	68.9	69.1
10	70.9	68.2
12	65.6	65.9
13	62.5	65.9
14	63.0	65.9
15	63.3	66.0
16	63.5	66.0
18	63.9	65.9
20	63.5	65.9
25	66.9	68.6
30	69.7	68.9
35	72.6	69.8
40	72.8	69.8
45	71.9	69.9
50	72.6	71.3
60	73.2	74.5
70	74.3	75.8
80	76.6	74.9
90	76.9	74.0
100	76.7	72.5
120	73.5	68.9
140	69.9	65.6
160	66.4	63.6
180	63.5	63.3
200	61.3	63.6
225	59.9	64.5
250	60.1	64.8
275	60.9	64.2
300	61.6	63.7
350	63.0	63.9
400	65.0	64.4
<b>Maximum</b>	<b>76.9</b>	<b>75.8</b>

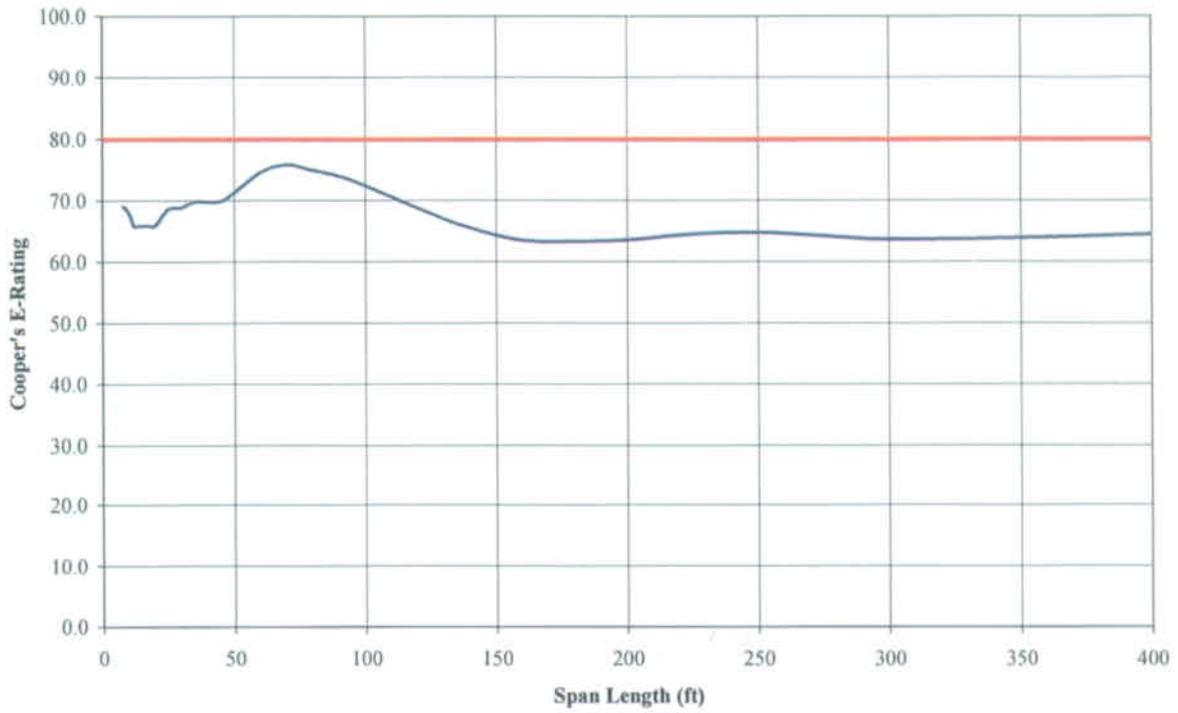


Figure F-7. Shear Rating-Navy D6b Consist

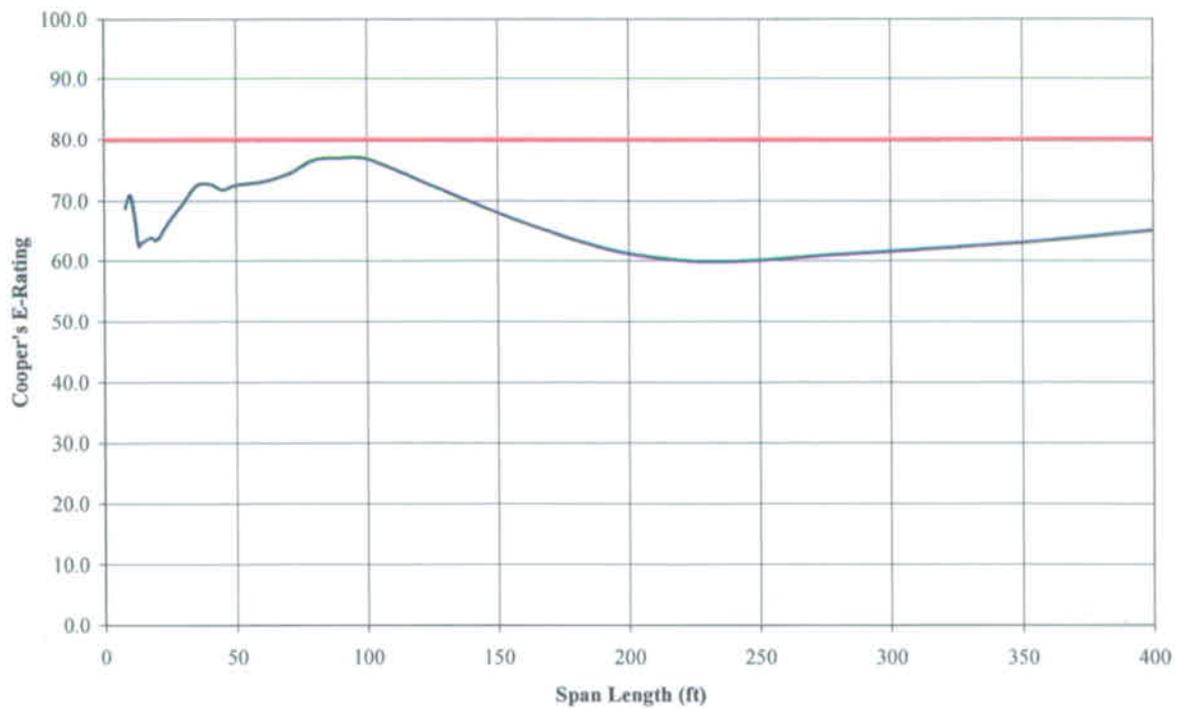


Figure F-8. Moment Rating-Navy D6b Consist

